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## **REPORT No. 124**

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**AERODYNAMIC CHARACTERISTICS OF AEROFOILS—II.**

**CONTINUATION OF REPORT No. 93**

**BY**

**NATIONAL ADVISORY COMMITTEE  
FOR AERONAUTICS**



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## AERODYNAMIC CHARACTERISTICS OF AEROFOILS—II.

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### INTRODUCTION.

This collection of data on aerofoils has been made from the published reports of a number of the leading aerodynamic laboratories of this country and Europe.<sup>1</sup> The information which was originally expressed according to the different customs of the several laboratories is here presented in a uniform series of charts and tables suitable for the use of designing engineers and for purposes of general reference.

It is a well-known fact that the results obtained in different laboratories, because of their individual methods of testing, are not strictly comparable even if proper scale corrections for size of model and speed of test are supplied. It is, therefore, unwise to compare too closely the coefficients of two wing sections tested in different laboratories. Tests of different wing sections from the same source, however, may be relied on to give true relative values.

The absolute system of coefficients has been used, since it is thought by the National Advisory Committee for Aeronautics that this system is the one most suited for international use and yet is one for which a desired transformation can be easily made. For this purpose a set of transformation constants is included in this report.

Each aerofoil section is given a reference number, and the test data are presented in the form of curves from which the coefficients can be read with sufficient accuracy for design purposes. The dimensions of the profile of each section are given at various stations along the chord in per cent of the chord, using as datum the line shown on the curves. The shape of the section is also shown in reasonable accuracy to enable one to more clearly visualize the section under consideration, together with its characteristics.

The authority for the results here presented is given as the name of the laboratory at which the experiments were conducted, with the size of model, wind velocity, and date of test.

### TRANSFORMATION COEFFICIENTS.

For the convenience of those who prefer to use a system of units other than the absolute system, there is given below a table of transformation constants based on the standard condition adopted by the National Advisory Committee for Aeronautics of—

Temperature = 15.6° C.

Pressure = 760 mm. Hg.

Humidity = 0.

Gravity = 9.80 m./sec.<sup>2</sup> = 32.2 ft./sec.<sup>2</sup>

thus giving values of specific weight of air

$$W = 0.1223 \text{ kg./m.}^3 = 0.07635 \text{ lbs./ft.}^3$$

and of density

$\rho = 0.01250$  in the French engineering or kilogram, meter, second system.

Or

$= 0.00238$  in the English or foot, pound, second system.

In absolute units.....	$P = C_p V^2$ .
In kg./m. <sup>2</sup> (m./sec.).....	$P = .1250 CV^2$ .
In kg./m. <sup>2</sup> (km./hr.).....	$P = .009645 CV^2$ .
In lbs./sq. ft. (ft./sec.).....	$P = .002378 CV^2$ .
In lbs./sq. ft. (mi./hr.).....	$P = .005116 CV^2$ .

<sup>1</sup> A previous collection on aerofoil sections 1 to 214 and charts 1 to 4 may be found in N. A. C. A. Report No. 93.

**INDEX.**

Three separate types of index are given—chart indexes which make it possible for a designer to select the wing section most suitable for the particular design in which he is interested; a group index which is arranged by countries and laboratories at which tests were conducted, each section also being designated by a reference number; and an alphabetical index.

**CHART INDEX.**

In order that the designer may easily pick out a wing section which is suited to the type of airplane on which he is working, four index charts are given which classify the wings according to their aerodynamic and structural properties. In the charts of this report a lower case letter is placed adjacent to the reference number giving VI<sub>L</sub> values, so that a comparison can be made without referring to the individual drawings.

In chart No. 5 the minimum drag is plotted against the L/D at one-fourth the maximum lift. This chart should be used in choosing a wing section for a high-speed airplane, the wing sections being more suited for this use the farther they are from the lower left-hand corner.

In chart No. 6 the mean spar depth is plotted against the maximum lift in order to show the possible strength and lightness of the wing structure. The higher the maximum lift coefficient is the smaller will be the wing area and the lighter the structural weight, and in the same way the greater the depth of the spars the lighter will be their weight, so that the sections the greatest distance from the lower left-hand corner will give the lightest and strongest wings.

The maximum L/D is plotted against the maximum lift in chart No. 7, which is of use in choosing the wing section for a slow and efficient airplane. In the same way as before, the sections farthest from the lower left-hand corner are the best for this purpose.

In chart No. 8 the L/D at two-thirds the maximum lift is plotted against the maximum lift, so that this chart can be used for choosing a section that will give an efficient climb or a long range at cruising speed. The best sections for this purpose will be the farthest from the lower lefthand corner of the chart.

## **CHART INDEX**

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	Page.
Chart No. 5.—Minimum drag plotted against the L/D at one-fourth the maximum lift.....	471
Chart No. 6.—Mean spar depth plotted against the maximum lift.....	472
Chart No. 7.—Maximum L/D plotted against maximum lift.....	473
Chart No. 8.—L/D at two-thirds the maximum lift plotted against the maximum lift.....	474

## GROUP INDEX.

Aerofoil.	Wind tunnel.	Report reference number.	Aerofoil.	Wind tunnel.	Report reference number.
<b>UNITED STATES.</b>					
U. S. A. 22.....	M. I. T.....	826	Göttingen 79 (Pfalz 11).....	Göttingen.....	215
U. S. A. 25.....	do.....	827	Göttingen 147 (M. V. A. II. 6).....	do.....	216
U. S. A. 26.....	do.....	828	Göttingen 164 (M. V. A. Mk. 10).....	do.....	217
U. S. A. 27.....	do.....	829	Göttingen 165 (M. V. A. Mk. 11).....	do.....	218
U. S. A. 28.....	do.....	830	Göttingen 173 (Albatros 6u2o).....	do.....	219
U. S. A. 29.....	do.....	831	Göttingen 174 (Albatros 6u2o).....	do.....	220
U. S. A. 30.....	do.....	871	Göttingen 178 (Albatros 7u2o).....	do.....	221
U. S. A. 31.....	do.....	872	Göttingen 184 (M. V. A. II. 29).....	do.....	222
U. S. A. 32.....	do.....	873	Göttingen 217 (M. V. A. Mk. 12).....	do.....	223
U. S. A. 33.....	do.....	874	Göttingen 222 (M. V. A. H. 33).....	do.....	224
U. S. A. 34.....	do.....	875	Göttingen 223 (M. V. A. II. 34).....	do.....	225
Glenn Martin 1.....	do.....	832	Göttingen 224 (M. V. A. Ca 1).....	do.....	226
Glenn Martin 2.....	do.....	833	Göttingen 225 (M. V. A. II. 35).....	do.....	227
Glenn Martin 3.....	do.....	834	Göttingen 226 (M. V. A. H. 36).....	do.....	228
Glenn Martin 4.....	do.....	835	Göttingen 227 (M. V. A. II. 37).....	do.....	229
Glenn Martin 5.....	do.....	836	Göttingen 228 (M. V. A. II. 38).....	do.....	230
Glenn Martin 6.....	do.....	837	Göttingen 229 (M. V. A. H. 39).....	do.....	231
A. E. G. 1.....	do.....	838	Göttingen 234 (M. V. A. Ca 5).....	do.....	232
A. E. G. 2.....	do.....	839	Göttingen 239 (M. V. A. H. 31).....	do.....	233
M-80 (Loening).....	W. N. Y.....	840	Göttingen 241 (M. V. A. Pr. 1).....	do.....	234
Springer 2.....	do.....	841	Göttingen 242 (M. V. A. Pr. 2).....	do.....	235
Springer 3.....	do.....	842	Göttingen 243 (M. V. A. Pr. 3).....	do.....	236
<b>BRITISH.</b>					
Fage & Collins 1.....	N. P. L.....	343	Göttingen 244 (M. V. A. Fr. 4).....	do.....	237
Fage & Collins 2.....	do.....	344	Göttingen 255 (M. V. A. Ca 6).....	do.....	238
Fage & Collins 3.....	do.....	345	Göttingen 256 (Flz. Junkers E).....	do.....	239
Fage & Collins 4.....	do.....	346	Göttingen 265 (Flz. Fr'hafen 41R1).....	do.....	240
Fage & Collins 5.....	do.....	347	Göttingen 281 (Daimler XII).....	do.....	241
Fage & Collins 6.....	do.....	348	Göttingen 284.....	do.....	242
Bristol Badger.....	do.....	349	Göttingen 285.....	do.....	243
Bristol Braemar.....	do.....	350	Göttingen 288.....	do.....	244
Powell (Plain).....	do.....	351	Göttingen 289.....	do.....	245
Searle & Peatfield 1.....	do.....	352	Göttingen 290.....	do.....	246
Searle & Peatfield 2.....	do.....	353	Göttingen 298 (Flz. Fokker Dr. 1).....	do.....	247
Searle & Peatfield 3.....	do.....	354	Göttingen 300 (Fr'hafen G20).....	do.....	248
Searle & Peatfield 4.....	do.....	355	Göttingen 301 (Fr'hafen G18).....	do.....	249
<b>FRENCH.</b>					
Eiffel 63.....	Eiffel.....	356	Göttingen 303 (Fr'hafen G03).....	do.....	250
Eiffel 64.....	do.....	357	Göttingen 304 (Fr'hafen G02).....	do.....	251
Eiffel 65.....	do.....	358	Göttingen 319 (Hansa-Brandenburg I.1).....	do.....	252
Eiffel 66.....	do.....	359	Göttingen 320 (Hansa-Brandenburg II.1).....	do.....	253
A R.....	do.....	360	Göttingen 321 (Hansa-Brandenburg III.1).....	do.....	254
Bleriot.....	do.....	361	Göttingen 322 (Hansa-Brandenburg IV.1).....	do.....	255
Coanda 1.....	do.....	362	Göttingen 323 (Hansa-Brandenburg V.1).....	do.....	256
Coanda 2.....	do.....	363	Göttingen 324 (Hansa-Brandenburg VI.1).....	do.....	257
Coanda 3.....	do.....	364	Göttingen 325 (Pfalz 54).....	do.....	258
Juvigny.....	do.....	365	Göttingen 329 (Pfalz 58).....	do.....	259
Kauffmann 111.....	do.....	366	Göttingen 330 (Pfalz 59).....	do.....	260
Odier 110.....	do.....	367	Göttingen 331 (Pfalz 60).....	do.....	261
Turin 3.....	do.....	368	Göttingen 332 (Pfalz 61).....	do.....	262
Turin 4.....	do.....	369	Göttingen 336 (D. F. W.).....	do.....	263
<b>ITALIAN.</b>					
Italian 307.....	Crocce.....	370	Göttingen 338 (M. V. A. H. 44).....	do.....	264
			Göttingen 344 (Pfalz 71).....	do.....	265
			Göttingen 346 (Fr'hafen Staaken).....	do.....	266

## Group index—Continued.

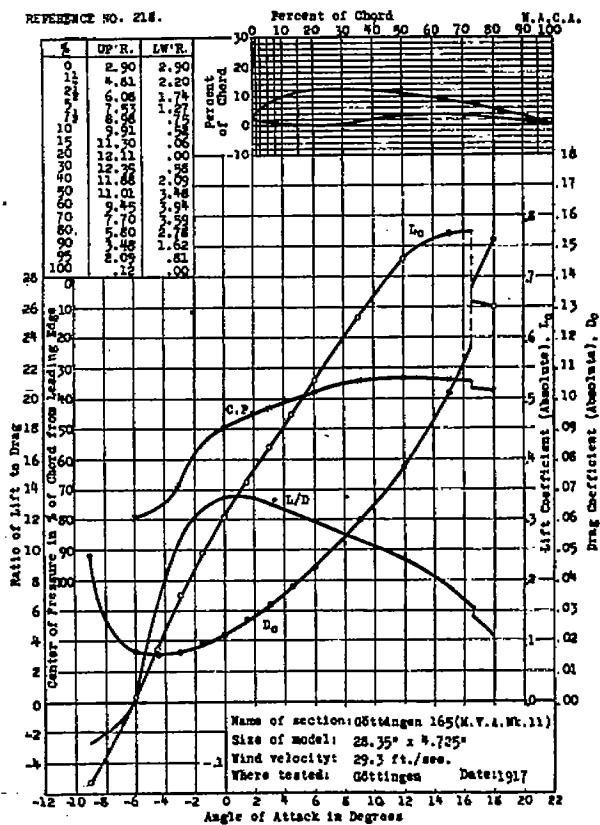
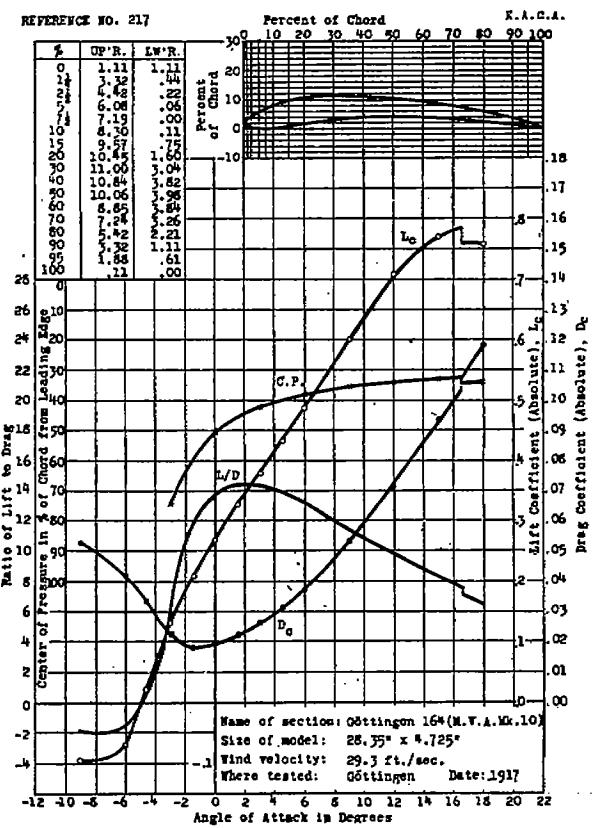
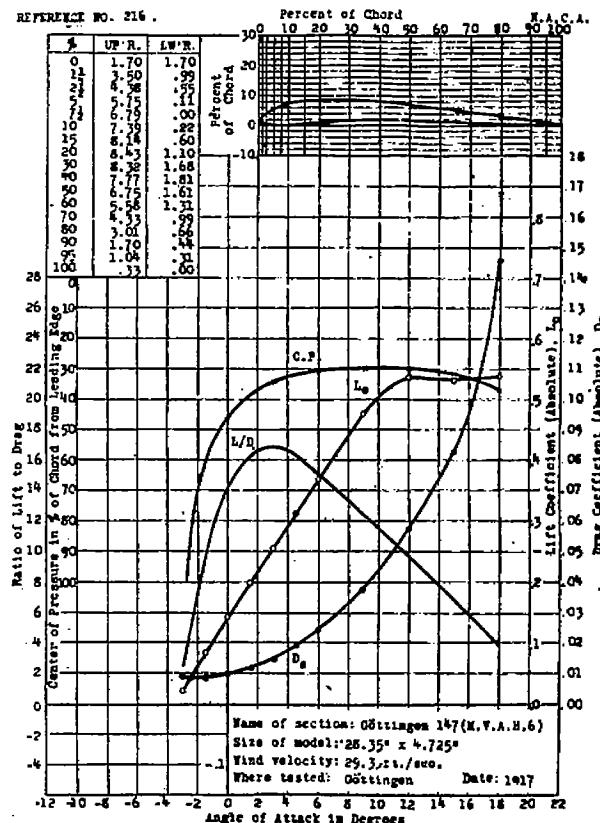
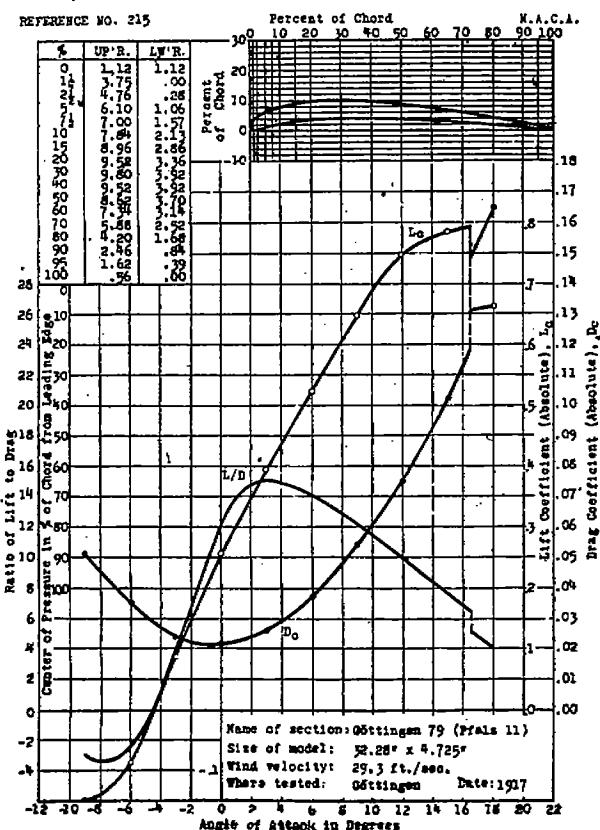
Aerofoil.	Wind tunnel.	Report reference number.	Aerofoil.	Wind tunnel.	Report reference number.
<b>GERMANY—continued.</b>					
Göttingen 358.....	Göttingen..	267	Göttingen 413.....	Göttingen..	297
Göttingen 360.....	do.....	268	Göttingen 414.....	do.....	298
Göttingen 363.....	do.....	269	Göttingen 415.....	do.....	299
Göttingen 364.....	do.....	270	Göttingen 416.....	do.....	300
Göttingen 365.....	do.....	271	Göttingen 418.....	do.....	301
Göttingen 366.....	do.....	272	Göttingen 420.....	do.....	302
Göttingen 367.....	do.....	273	Göttingen 421.....	do.....	303
Göttingen 381.....	do.....	274	Göttingen 422.....	do.....	304
Göttingen 382.....	do.....	275	Göttingen 423.....	do.....	305
Göttingen 383.....	do.....	276	Göttingen 424.....	do.....	306
Göttingen 384.....	do.....	277	Göttingen 425.....	do.....	307
Göttingen 385.....	do.....	278	Göttingen 426.....	do.....	308
Göttingen 386.....	do.....	279	Göttingen 429.....	do.....	309
Göttingen 387.....	do.....	280	Göttingen 430.....	do.....	310
Göttingen 388.....	do.....	281	Göttingen 431.....	do.....	311
Göttingen 389.....	do.....	282	Göttingen 432.....	do.....	312
Göttingen 390.....	do.....	283	Göttingen 433.....	do.....	313
Göttingen 393.....	do.....	284	Göttingen 434.....	do.....	314
Göttingen 394.....	do.....	285	Göttingen 435.....	do.....	315
Göttingen 395.....	do.....	286	Göttingen 436.....	do.....	316
Göttingen 398.....	do.....	287	Göttingen 440.....	do.....	317
Göttingen 400.....	do.....	288	Göttingen 441.....	do.....	318
Göttingen 404.....	do.....	289	Göttingen 446.....	do.....	319
Göttingen 405.....	do.....	290	Göttingen 447.....	do.....	320
Göttingen 406.....	do.....	291	Göttingen 448.....	do.....	321
Göttingen 407.....	do.....	292	Göttingen 449.....	do.....	322
Göttingen 409.....	do.....	293	Göttingen 450.....	do.....	323
Göttingen 410.....	do.....	294	Göttingen 459.....	do.....	324
Göttingen 411.....	do.....	295	Göttingen 460.....	do.....	325
Göttingen 412.....	do.....	296			

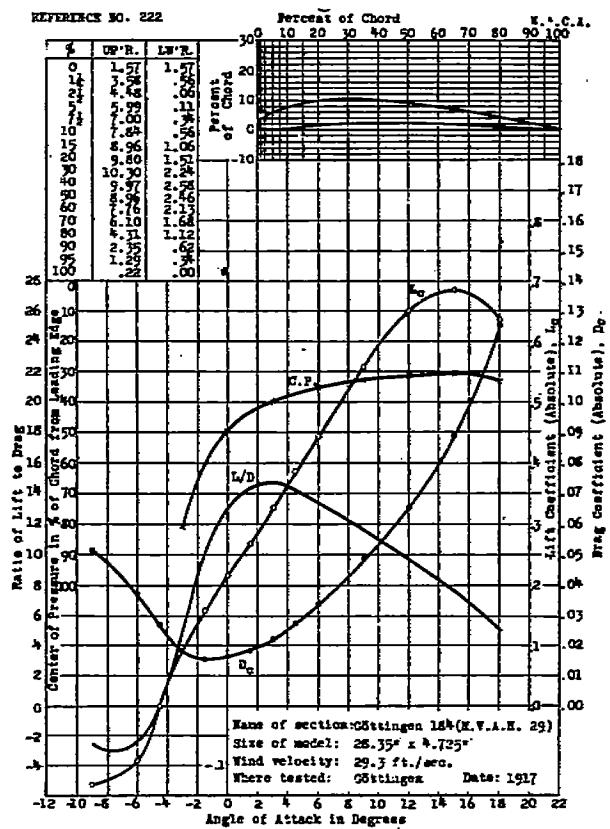
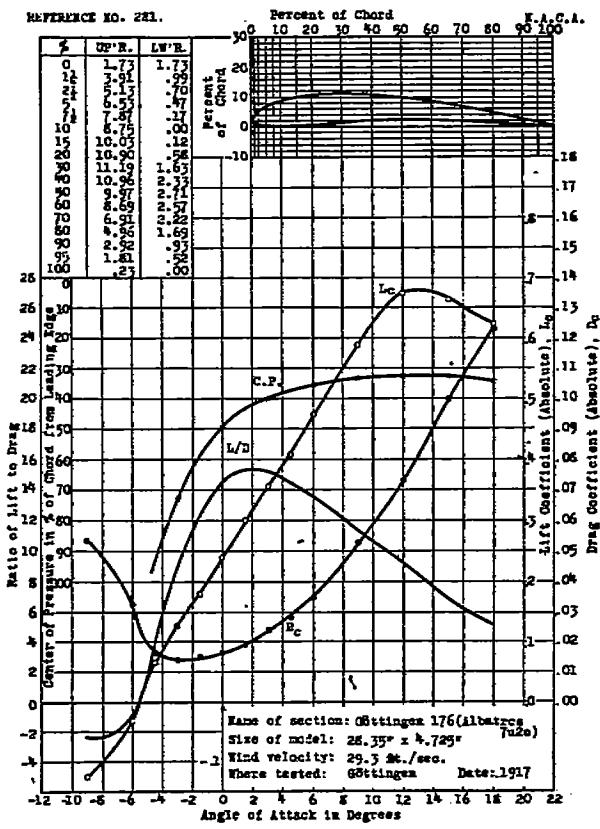
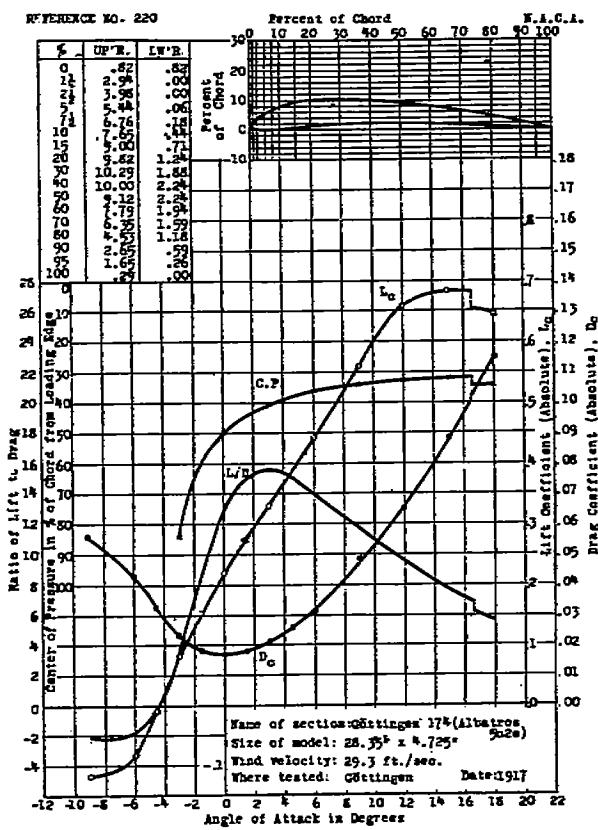
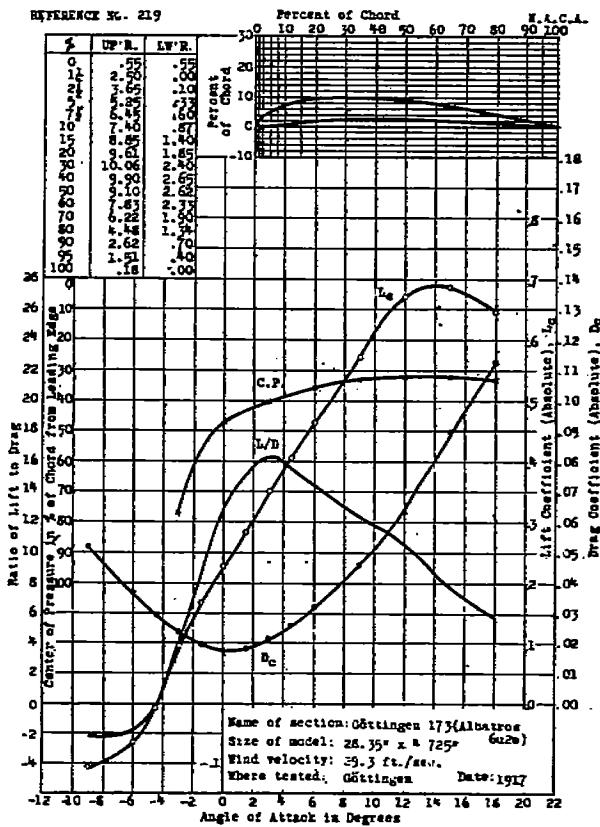
## ALPHABETICAL INDEX.

Aerofoil.	Report reference No.	Aerofoil.	Report reference No.
A. E. G. 1.....	338	Göttingen 331 (Pfalz 60).....	201
A. E. G. 2.....	339	Göttingen 332 (Pfalz 61).....	262
A. R.....	360	Göttingen 335 (D. F. W.).....	263
Bleriot.....	361	Göttingen 336 (M. V. A. H. 44).....	264
Bristol Badger.....	349	Göttingen 344 (Pfalz 71).....	265
Bristol Braemar.....	350	Göttingen 346 (Fr'hafen Staaken).....	266
Coanda 1.....	362	Göttingen 358.....	267
Coanda 2.....	363	Göttingen 360.....	268
Coanda 3.....	364	Göttingen 363.....	269
Eiffel 63.....	356	Göttingen 364.....	270
Eiffel 64.....	357	Göttingen 365.....	271
Eiffel 65.....	358	Göttingen 366.....	272
Eiffel 66.....	359	Göttingen 367.....	273
Fage & Collins 1.....	343	Göttingen 381.....	274
Fage & Collins 2.....	344	Göttingen 382.....	275
Fage & Collins 3.....	345	Göttingen 383.....	276
Fage & Collins 4.....	346	Göttingen 384.....	277
Fage & Collins 5.....	347	Göttingen 385.....	278
Fage & Collins 6.....	348	Göttingen 386.....	279
Göttingen 79 (Pfalz 11).....	215	Göttingen 387.....	280
Göttingen 147 (M. V. A. H. 6).....	216	Göttingen 388.....	281
Göttingen 164 (M. V. A. Mk. 10).....	217	Göttingen 389.....	282
Göttingen 165 (M. V. A. Mk. 11).....	218	Göttingen 390.....	283
Göttingen 173 (Albatros 6u2o).....	219	Göttingen 393.....	284
Göttingen 174 (Albatros 5u2o).....	220	Göttingen 394.....	285
Göttingen 176 (Albatros 7u2o).....	221	Göttingen 395.....	286
Göttingen 184 (M. V. A. H. 29).....	222	Göttingen 398.....	287
Göttingen 217 (M. V. A. Mk. 12).....	223	Göttingen 400.....	288
Göttingen 222 (M. V. A. H. 33).....	224	Göttingen 404.....	289
Göttingen 223 (M. V. A. H. 34).....	225	Göttingen 405.....	290
Göttingen 224 (M. V. A. Ca 1).....	226	Göttingen 406.....	291
Göttingen 225 (M. V. A. H. 35).....	227	Göttingen 407.....	292
Göttingen 226 (M. V. A. H. 36).....	228	Göttingen 409.....	293
Göttingen 227 (M. V. A. H. 37).....	229	Göttingen 410.....	294
Göttingen 228 (M. V. A. H. 38).....	230	Göttingen 411.....	295
Göttingen 229 (M. V. A. H. 39).....	231	Göttingen 412.....	296
Göttingen 234 (M. V. A. Ca 5).....	232	Göttingen 413.....	297
Göttingen 239 (M. V. A. H. 31).....	233	Göttingen 414.....	298
Göttingen 241 (M. V. A. Pr. 1).....	234	Göttingen 415.....	299
Göttingen 242 (M. V. A. Pr. 2).....	235	Göttingen 416.....	300
Göttingen 243 (M. V. A. Pr. 3).....	236	Göttingen 418.....	301
Göttingen 244 (M. V. A. Pr. 4).....	237	Göttingen 420.....	302
Göttingen 255 (M. V. A. Ca 6).....	238	Göttingen 421.....	303
Göttingen 256 (Flz. Junkers E).....	239	Göttingen 422.....	304
Göttingen 265 (Flz. Fr'hafen 41R1).....	240	Göttingen 423.....	305
Göttingen 281 (Daimler XII).....	241	Göttingen 424.....	306
Göttingen 284.....	242	Göttingen 425.....	307
Göttingen 285.....	243	Göttingen 426.....	308
Göttingen 288.....	244	Göttingen 428.....	309
Göttingen 289.....	245	Göttingen 430.....	310
Göttingen 290.....	246	Göttingen 431.....	311
Göttingen 298 (Flz. Fokker Dr. 1).....	247	Göttingen 432.....	312
Göttingen 300 (Fr'hafen G20).....	248	Göttingen 433.....	313
Göttingen 301 (Fr'hafen G13).....	249	Göttingen 434.....	314
Göttingen 303 (Fr'hafen G03).....	250	Göttingen 435.....	315
Göttingen 304 (Fr'hafen G02).....	251	Göttingen 436.....	316
Göttingen 319 (Hansa-Brandenburg I. 1).....	252	Göttingen 440.....	317
Göttingen 320 (Hansa-Brandenburg II. 1).....	253	Göttingen 441.....	318
Göttingen 321 (Hansa-Brandenburg III. 1).....	254	Göttingen 446.....	319
Göttingen 322 (Hansa-Brandenburg IV. 1).....	255	Göttingen 447.....	320
Göttingen 323 (Hansa-Brandenburg V. 1).....	256	Göttingen 448.....	321
Göttingen 324 (Hansa-Brandenburg).....	257	Göttingen 449.....	322
Göttingen 325 (Pfalz 54).....	258	Göttingen 450.....	323
Göttingen 329 (Pfalz 58).....	259	Göttingen 459.....	324
Göttingen 330 (Pfalz 59).....	260	Göttingen 460.....	325

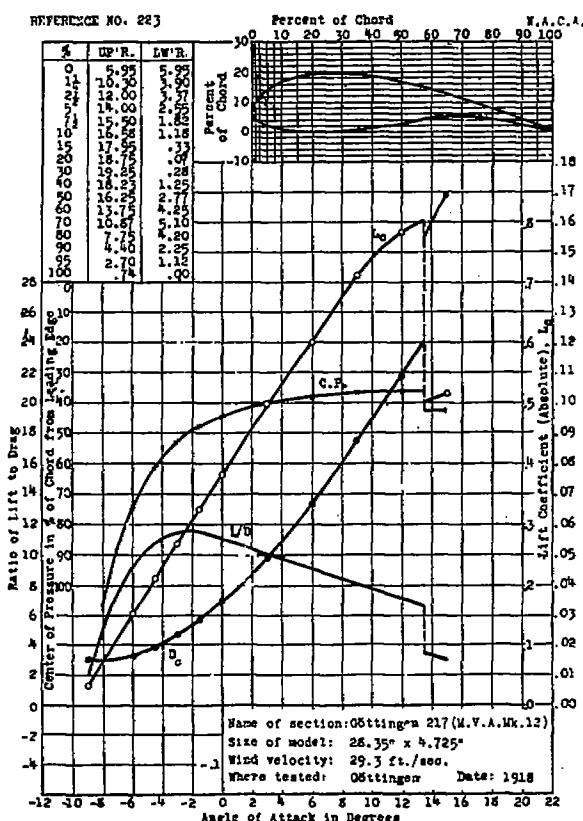
*Alphabetical index—Continued.*

Aerofoil.	Report reference No.	Aerofoil.	Report reference No.
Italian 307.....	370	Springer 2.....	341
Juvigny.....	365	Springer 3.....	342
Kauffmann 111.....	366	Turin 3.....	368
M-80 (Loening).....	340	Turin 4.....	369
Martin, Glenn 1.....	332	U. S. A. 22.....	326
Martin, Glenn 2.....	333	U. S. A. 25.....	327
Martin, Glenn 3.....	334	U. S. A. 26.....	328
Martin, Glenn 4.....	335	U. S. A. 27.....	329
Martin, Glenn 5.....	336	U. S. A. 28.....	330
Martin, Glenn 6.....	337	U. S. A. 29.....	331
Odier 110.....	367	U. S. A. 30.....	371
Powell (Plain).....	351	U. S. A. 31.....	372
Searle & Peatfield 1.....	352	U. S. A. 32.....	373
Searle & Peatfield 2.....	353	U. S. A. 33.....	374
Searle & Peatfield 3.....	354	U. S. A. 34.....	375
Searle & Peatfield 4.....	355		

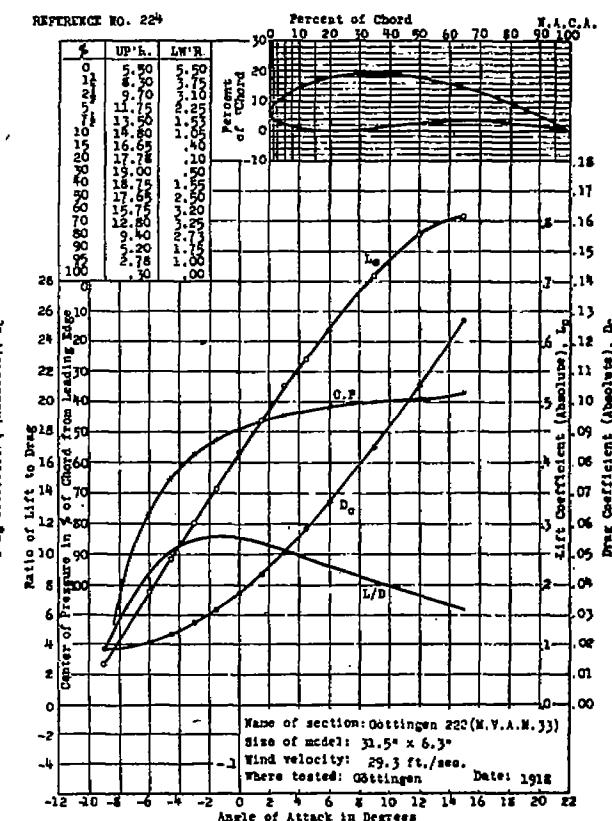




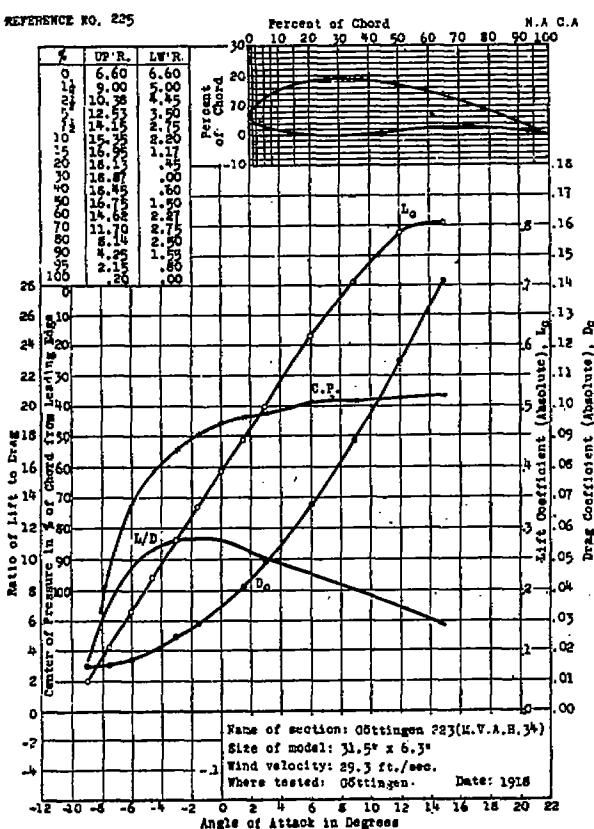
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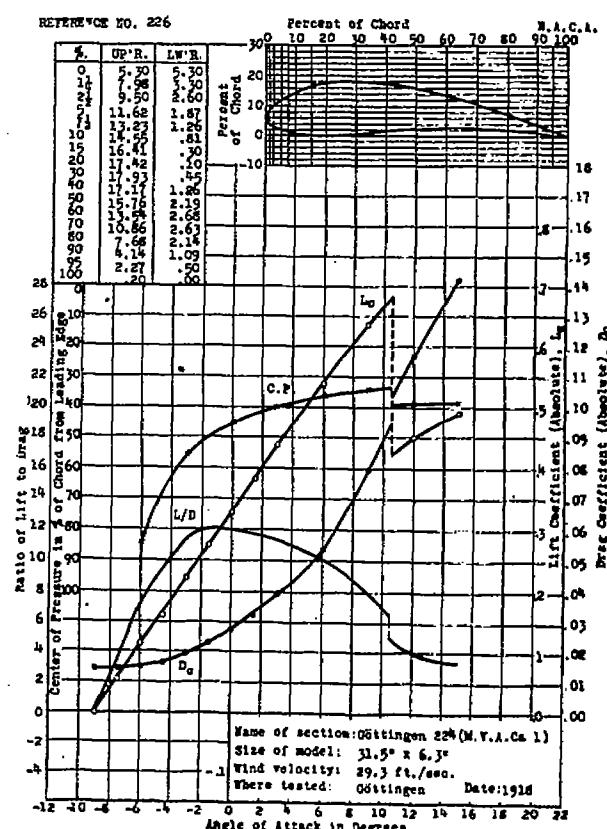
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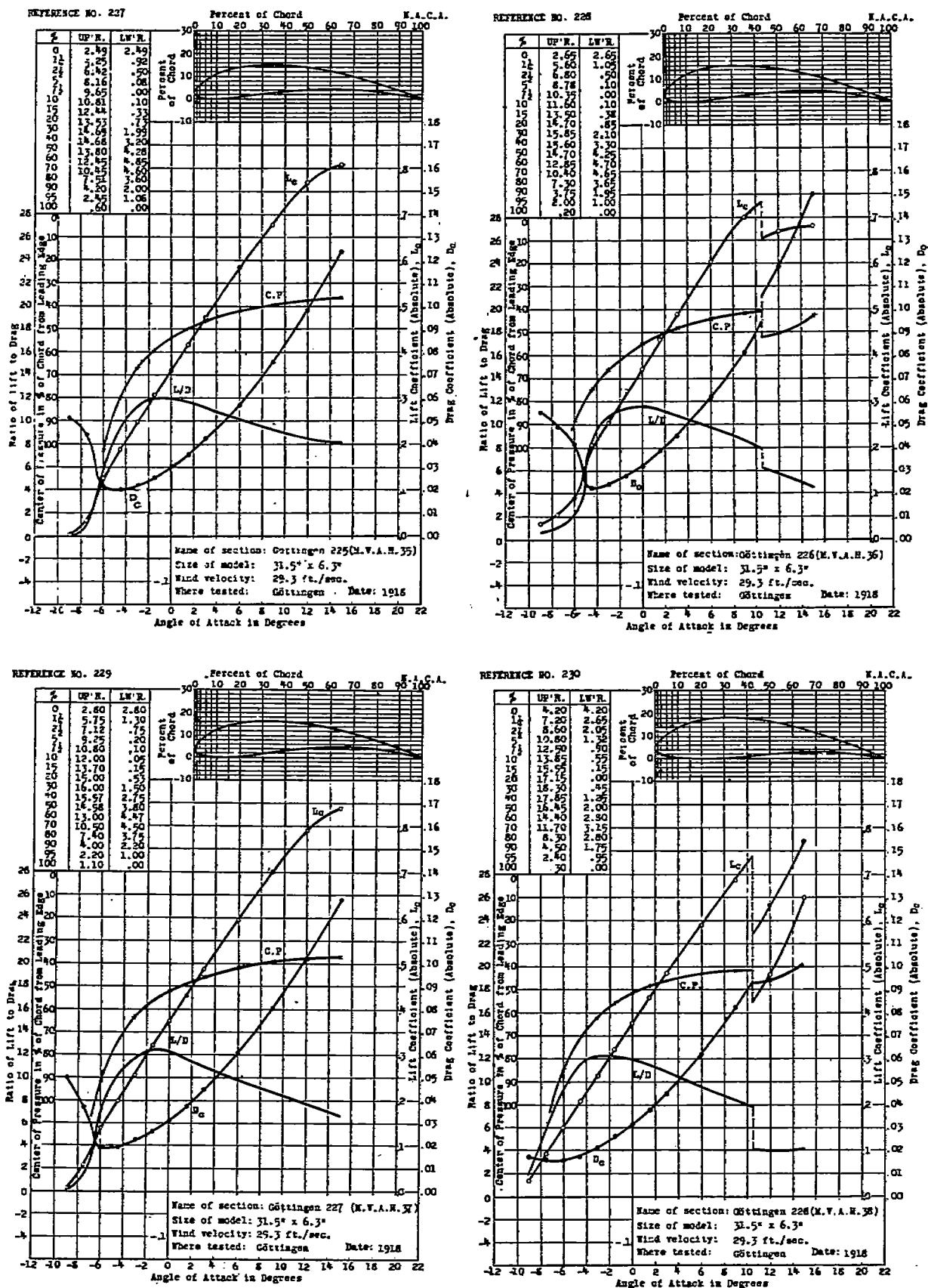


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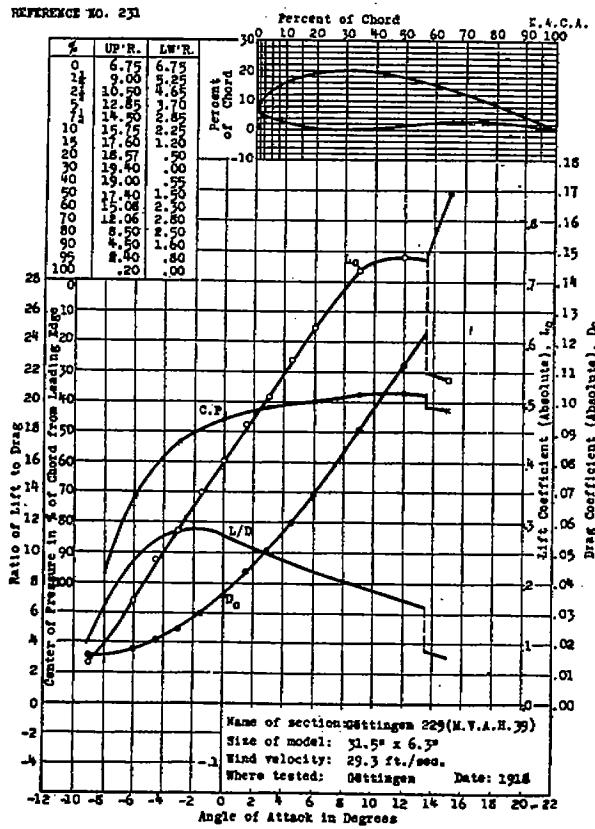


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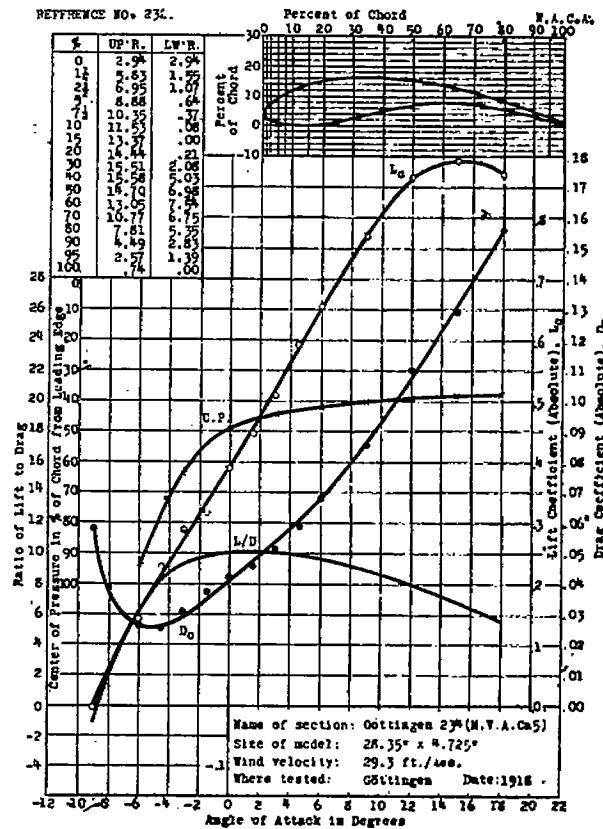




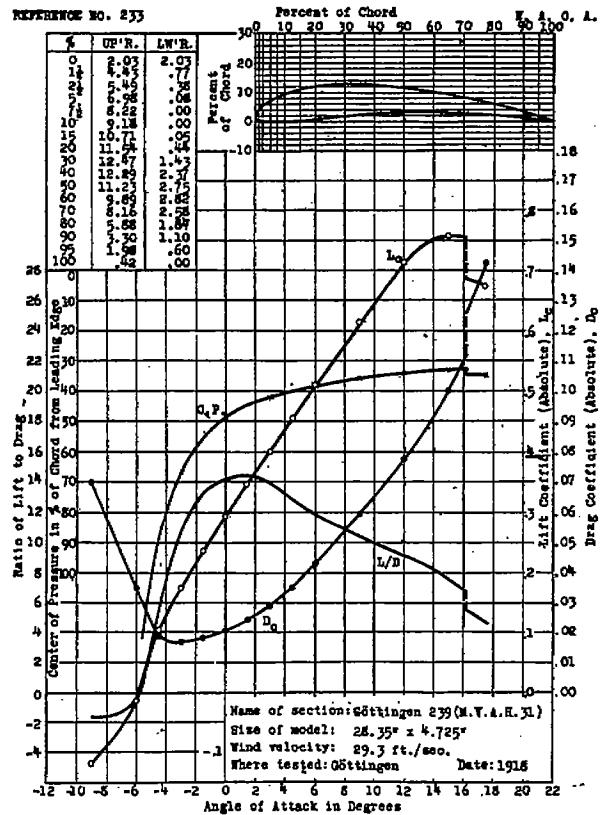
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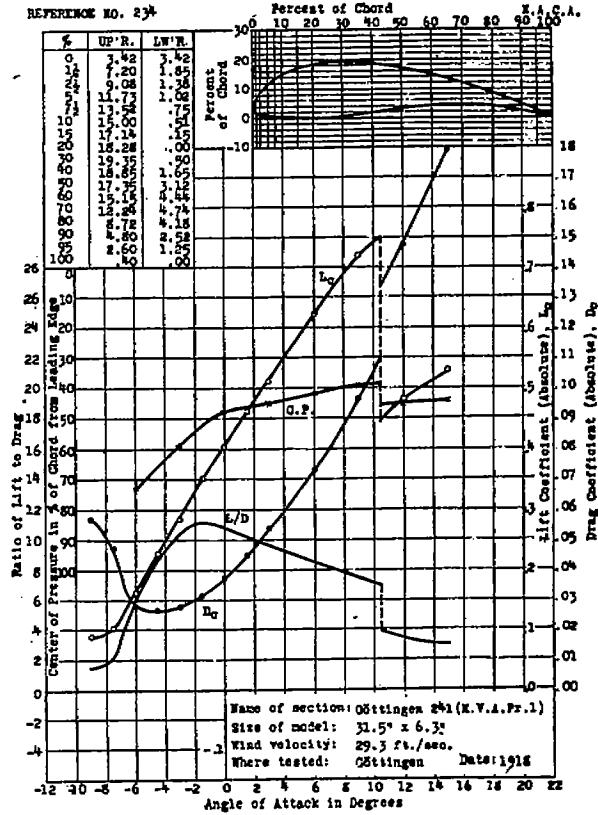
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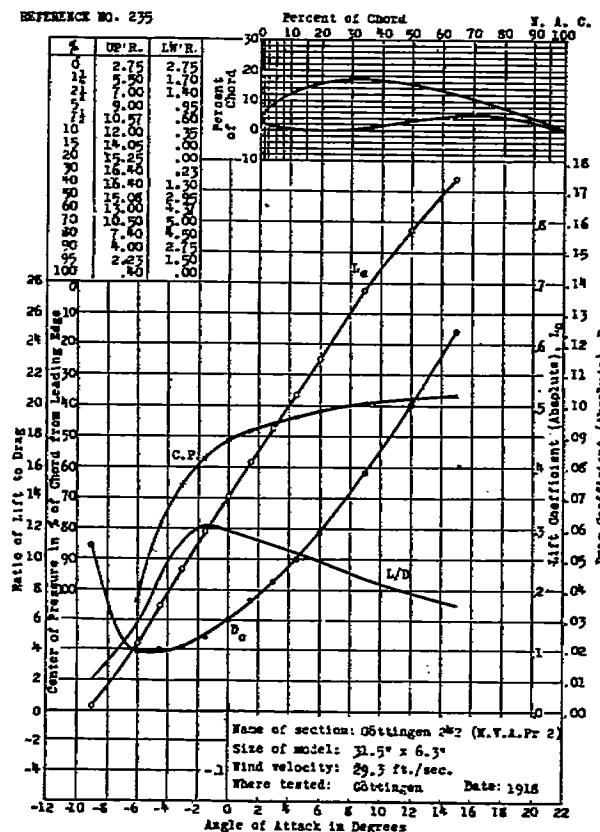
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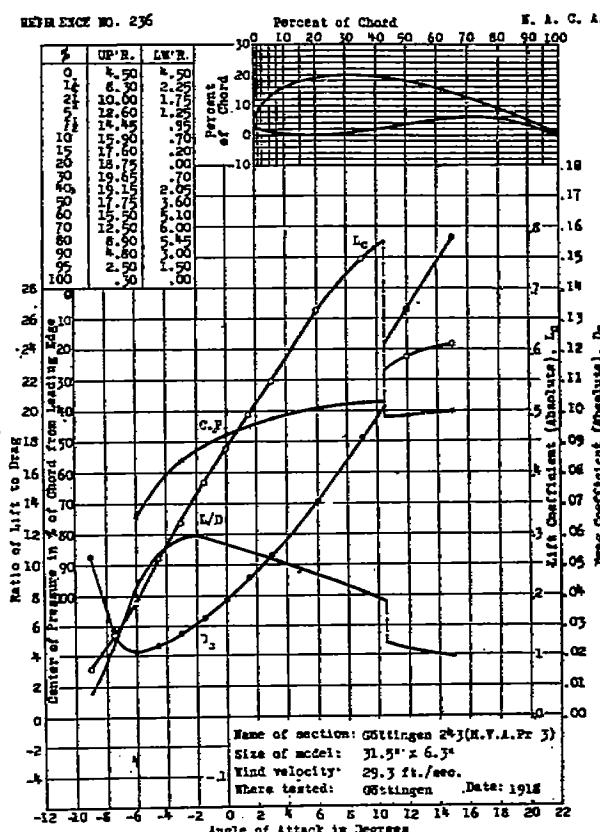
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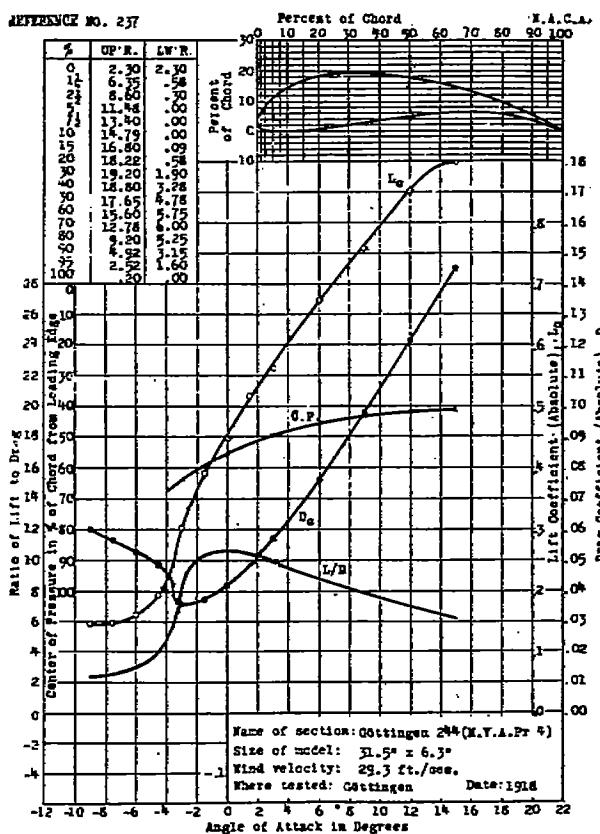
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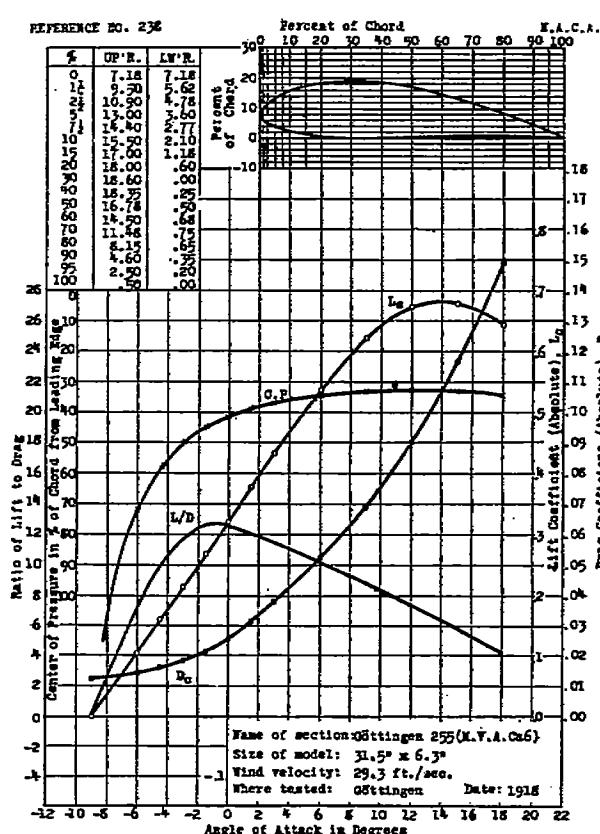
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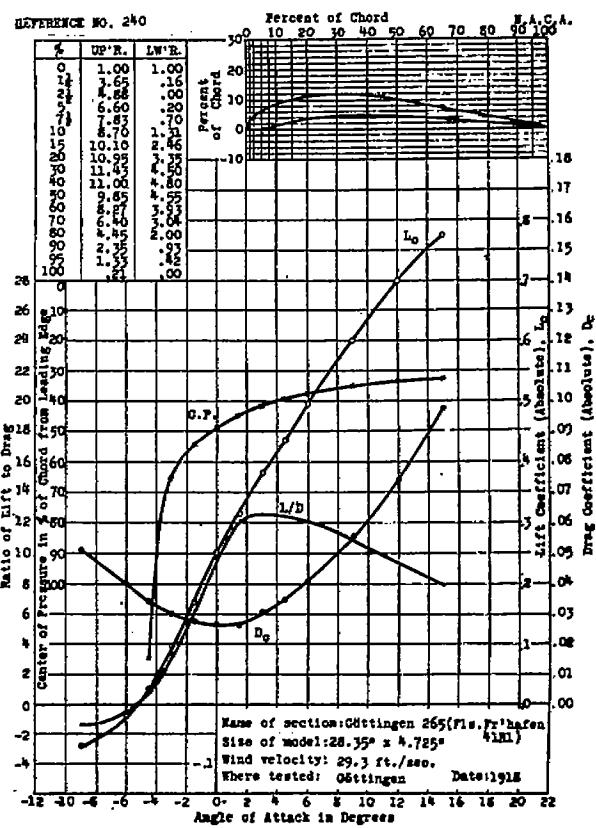
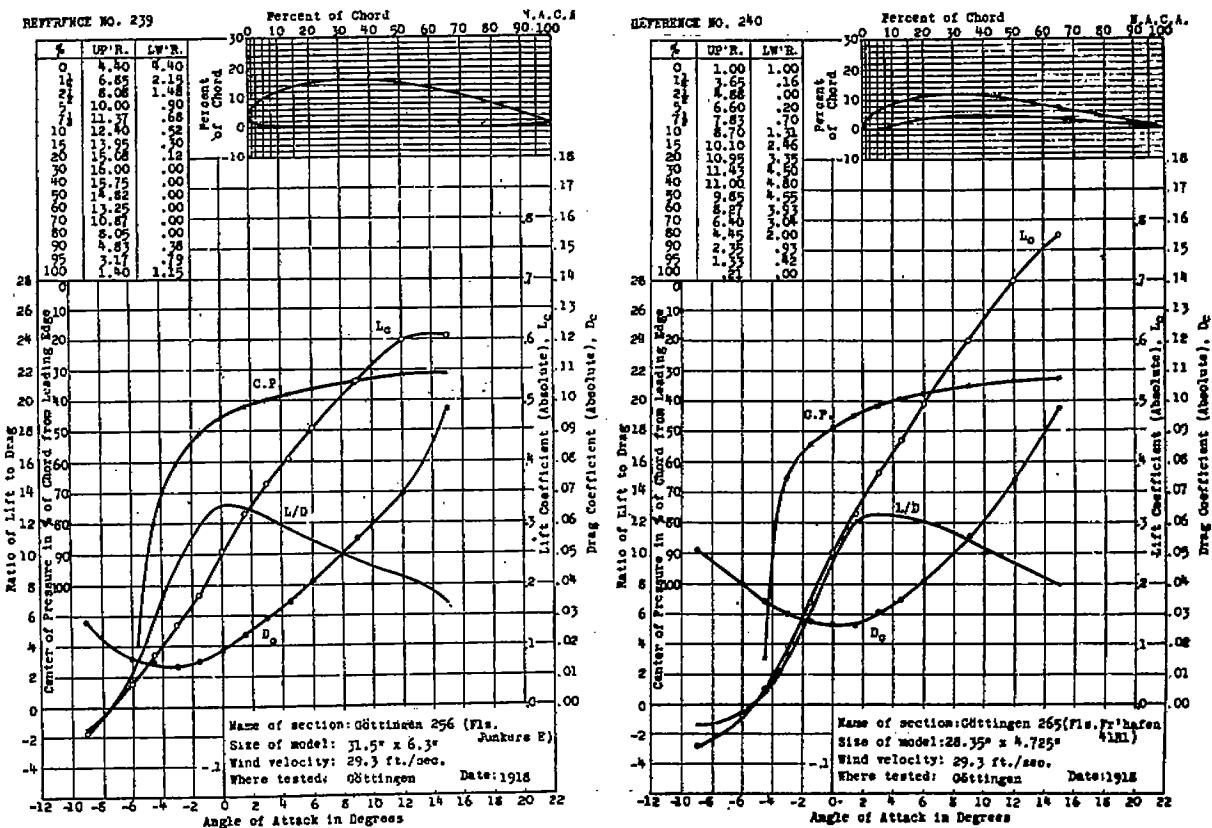


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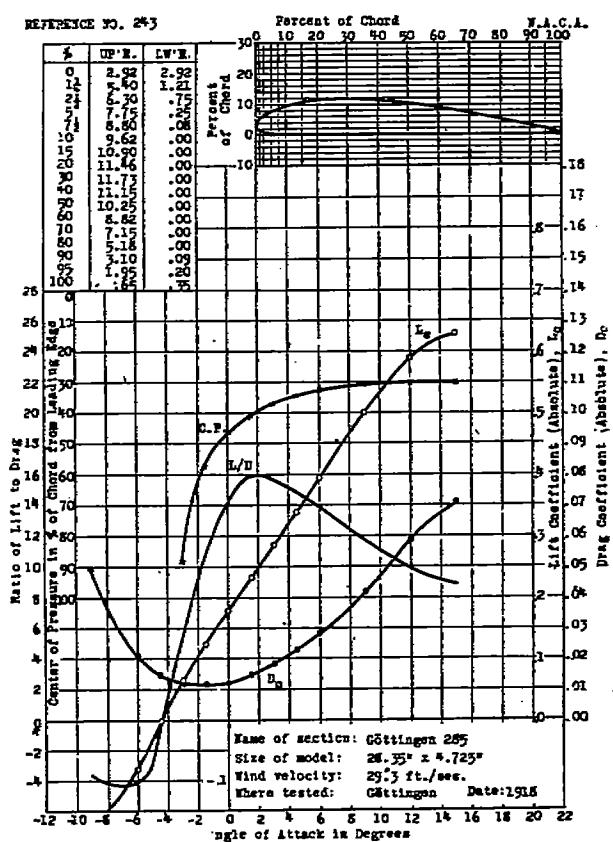


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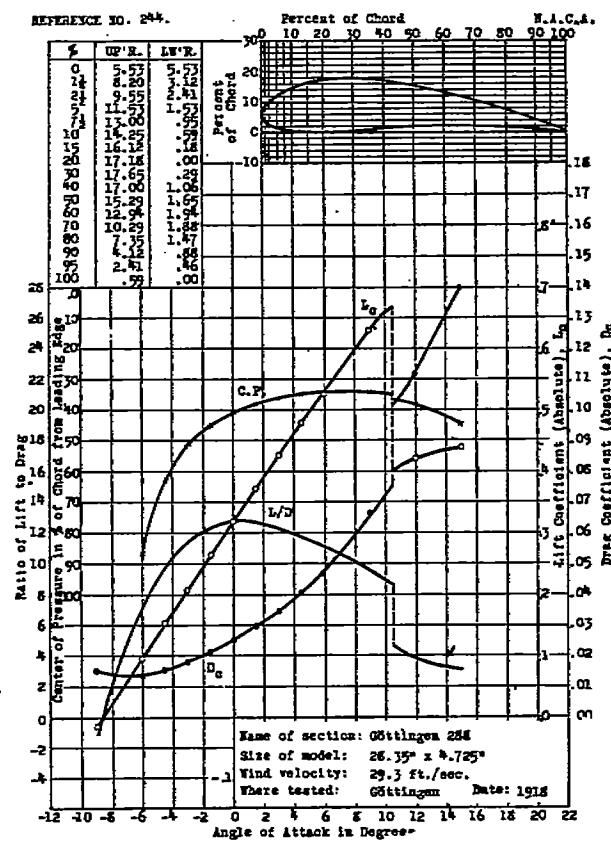




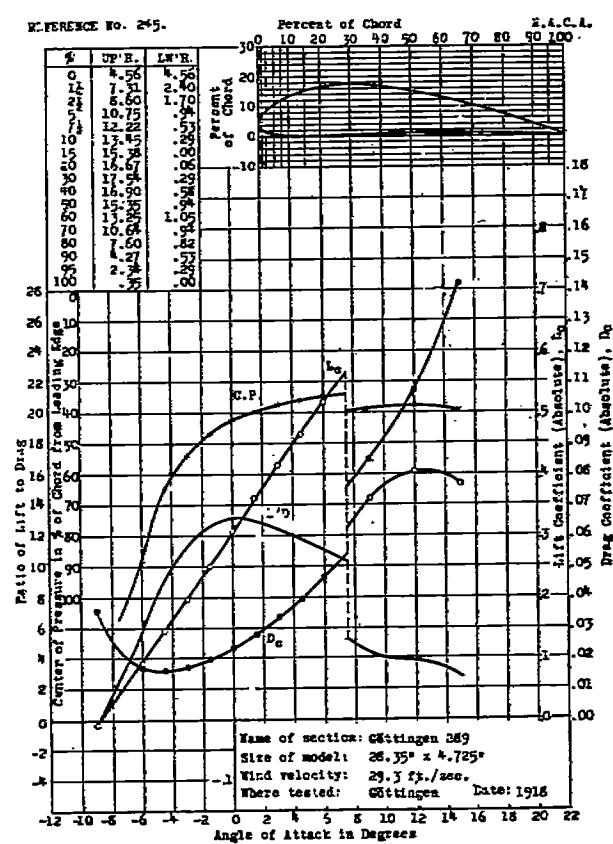
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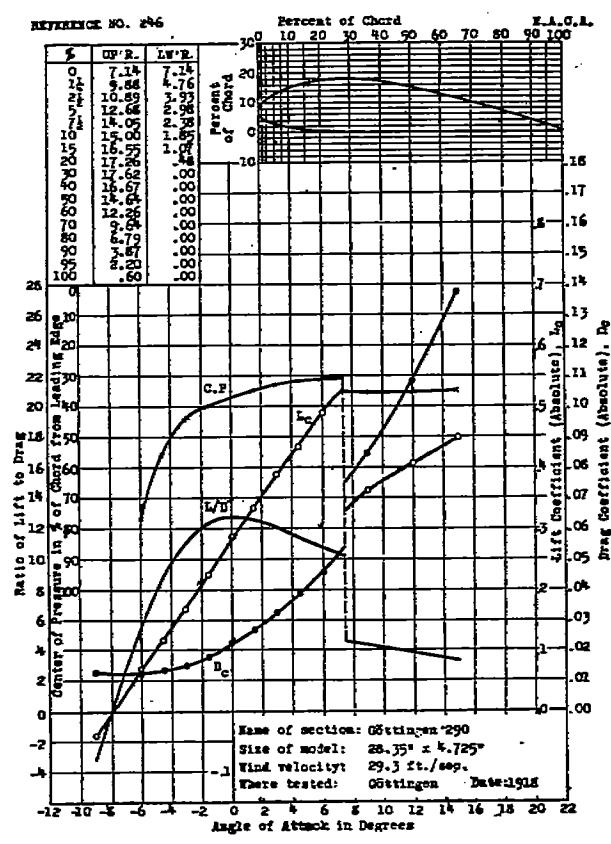
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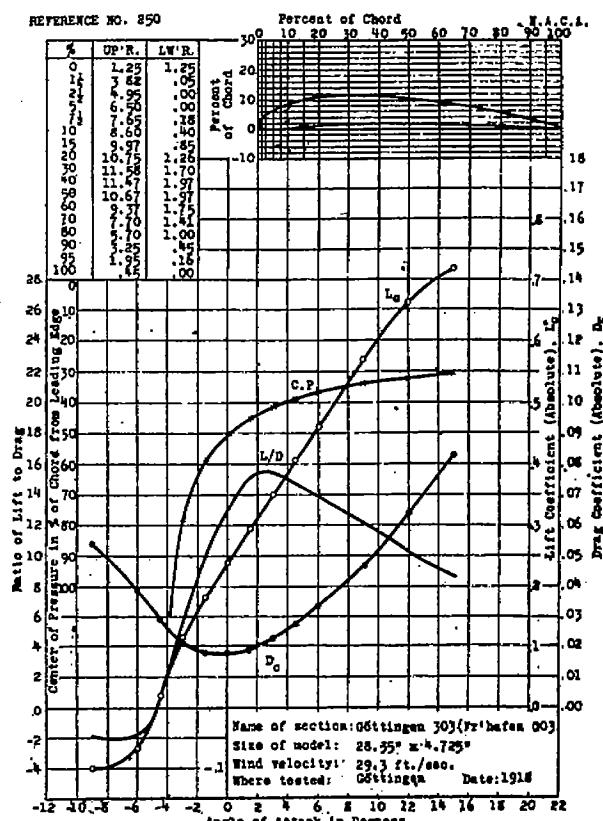
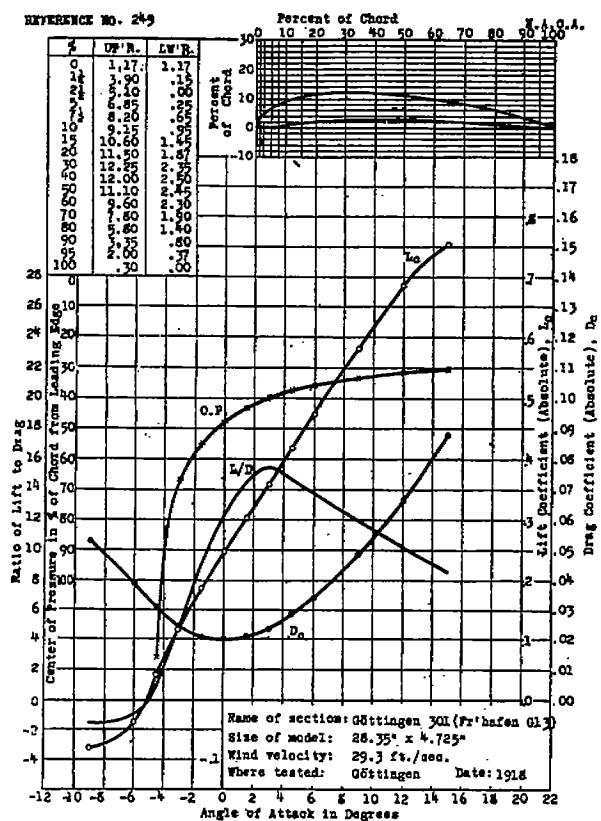
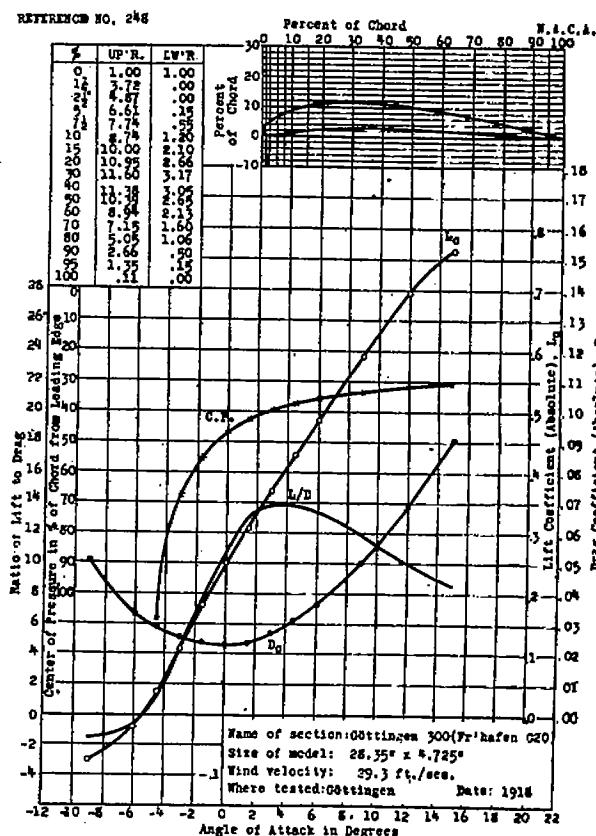
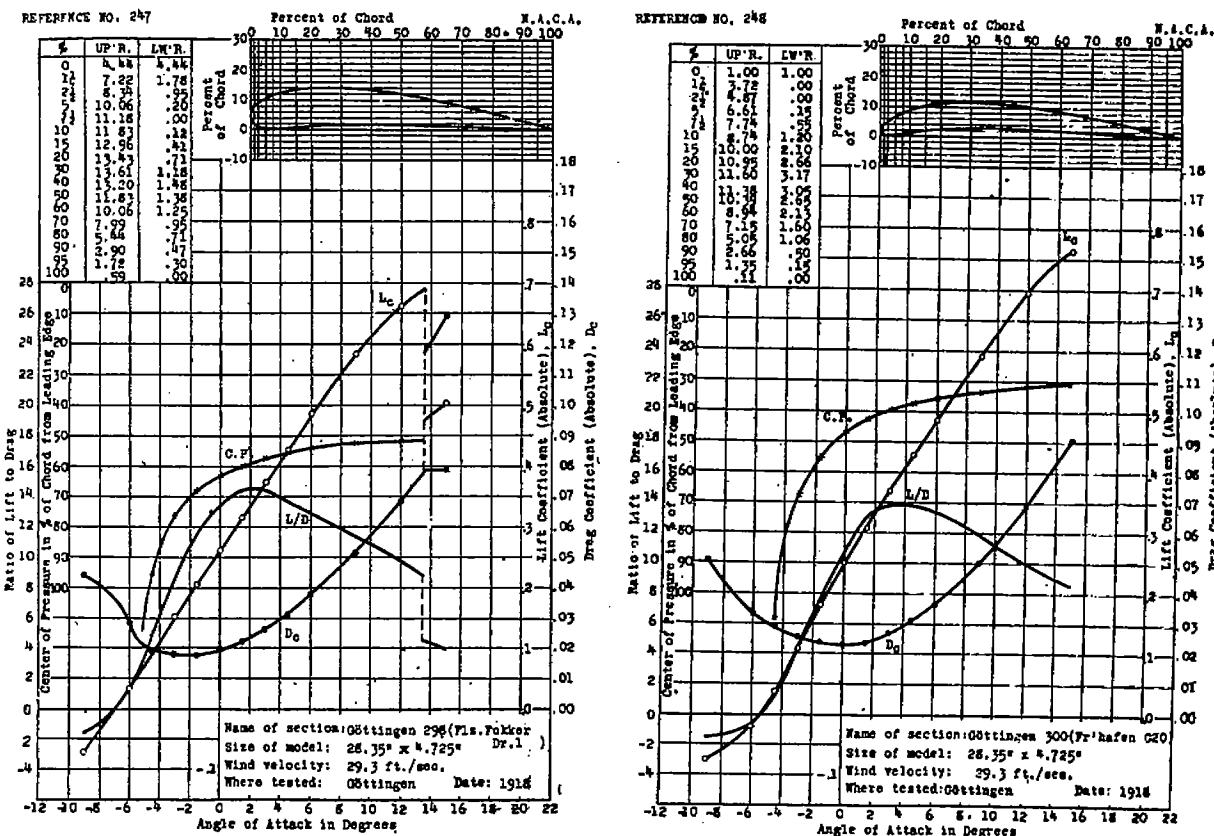


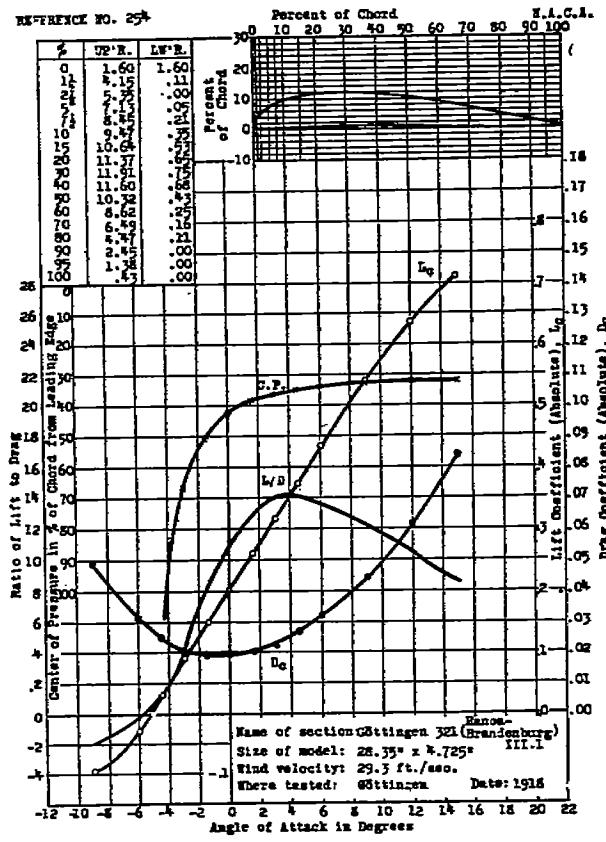
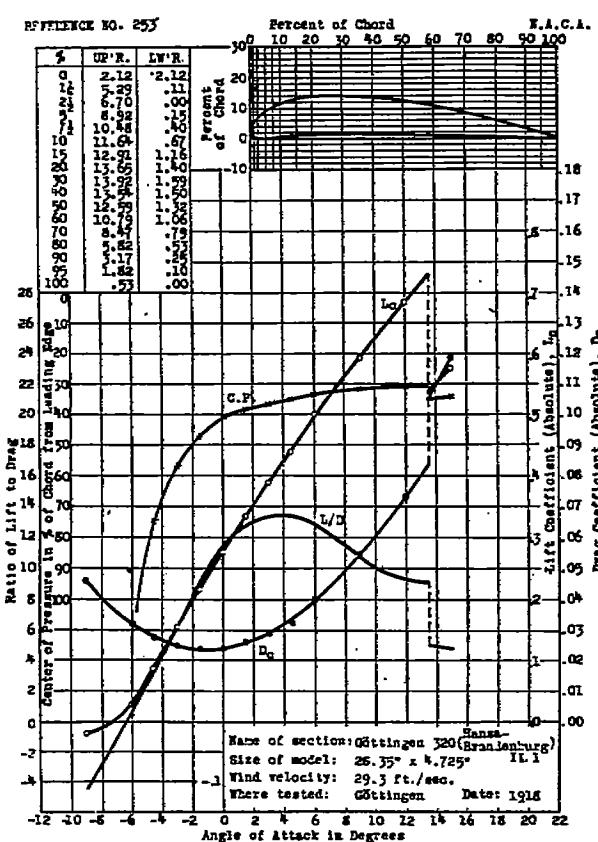
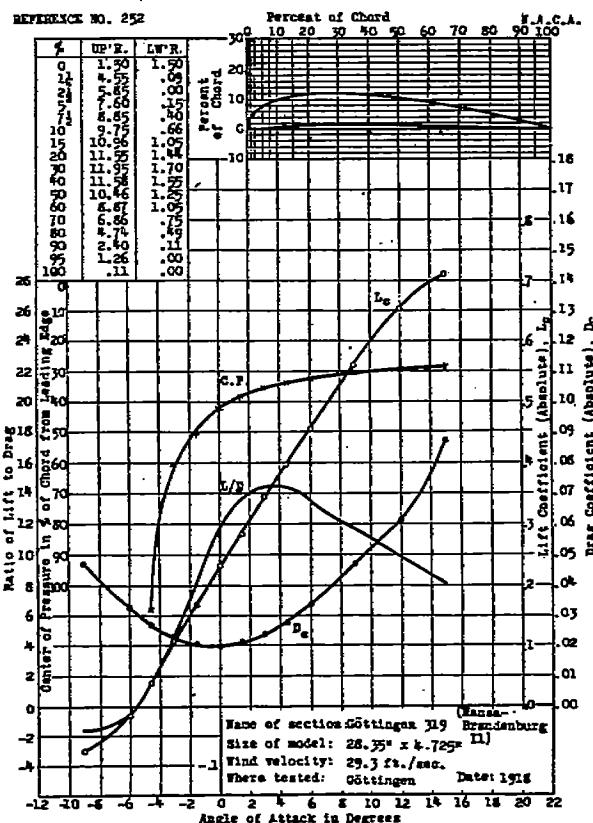
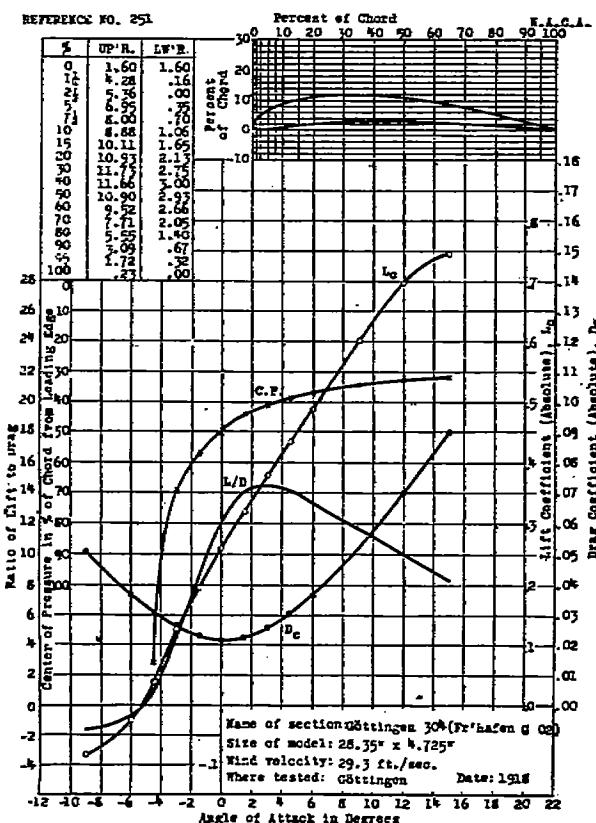
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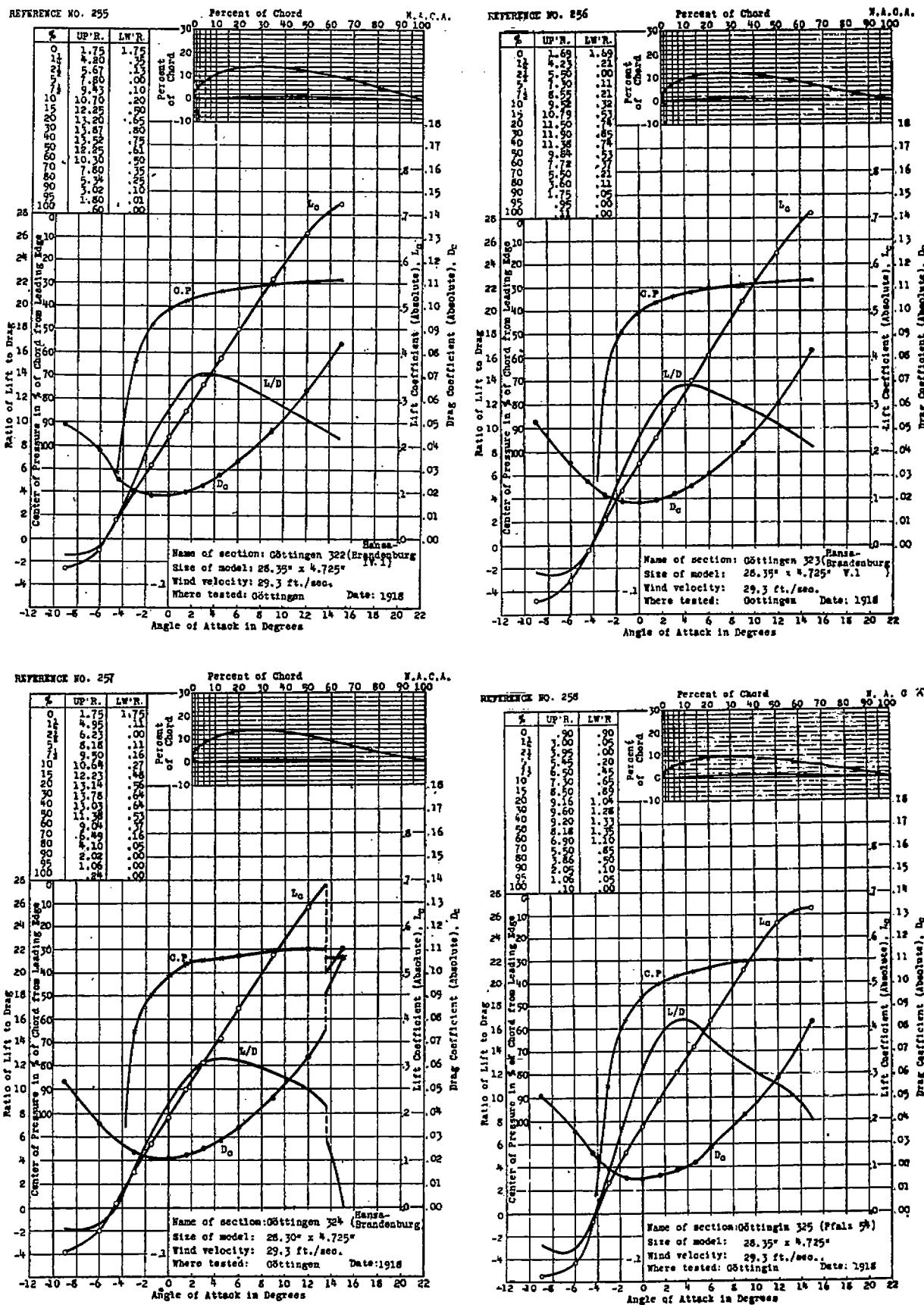


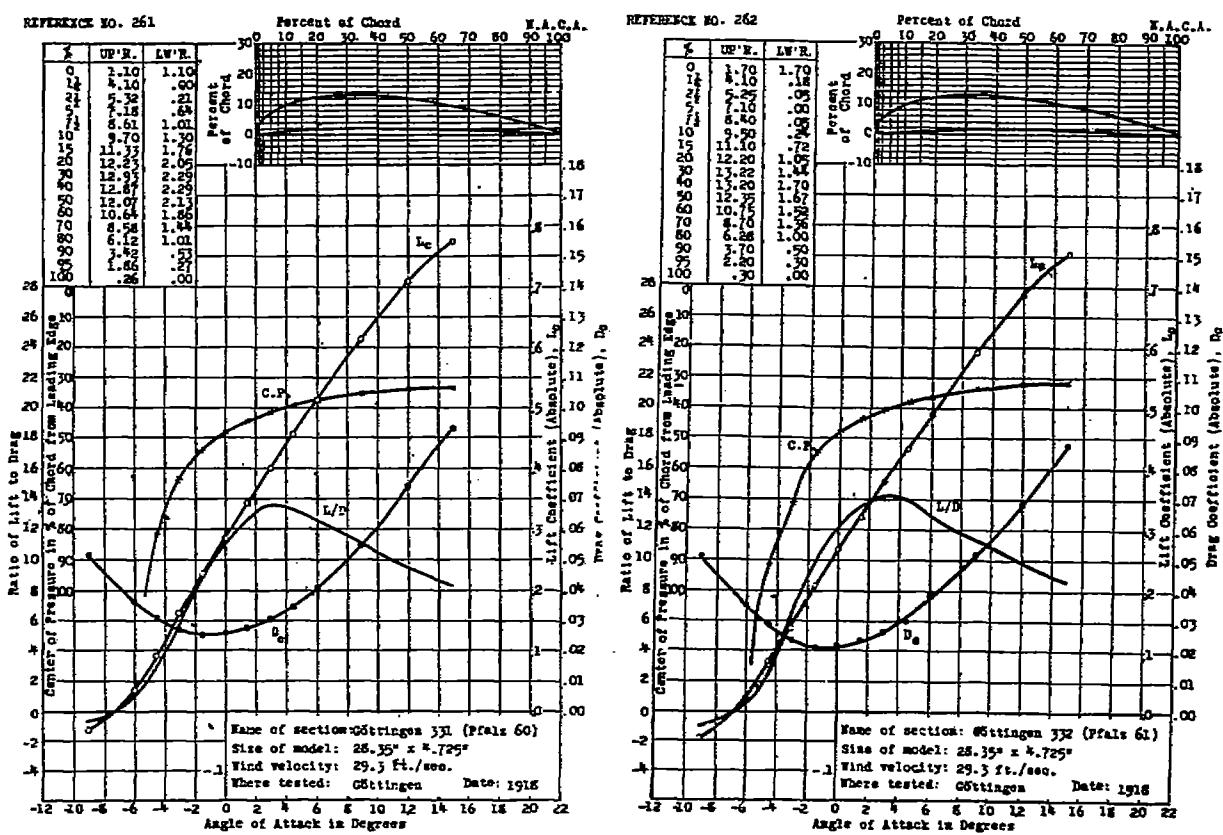
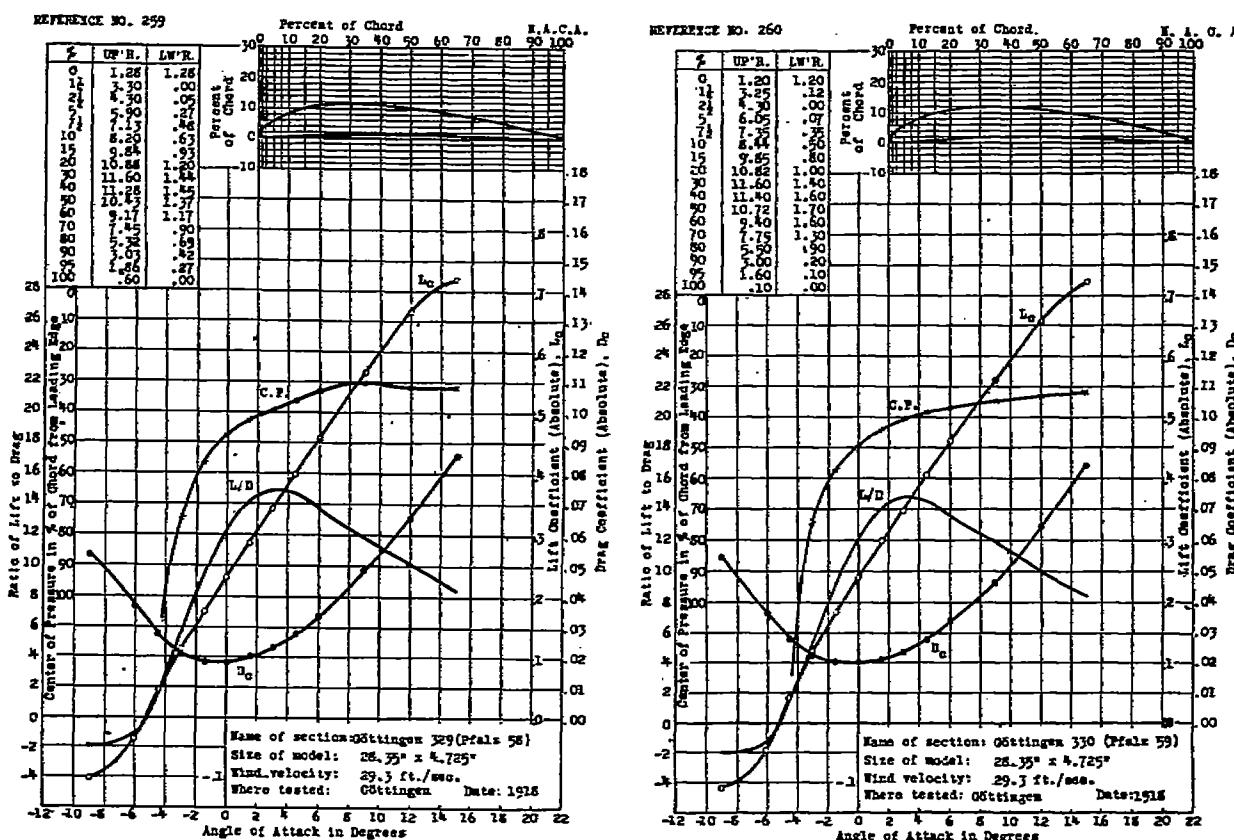
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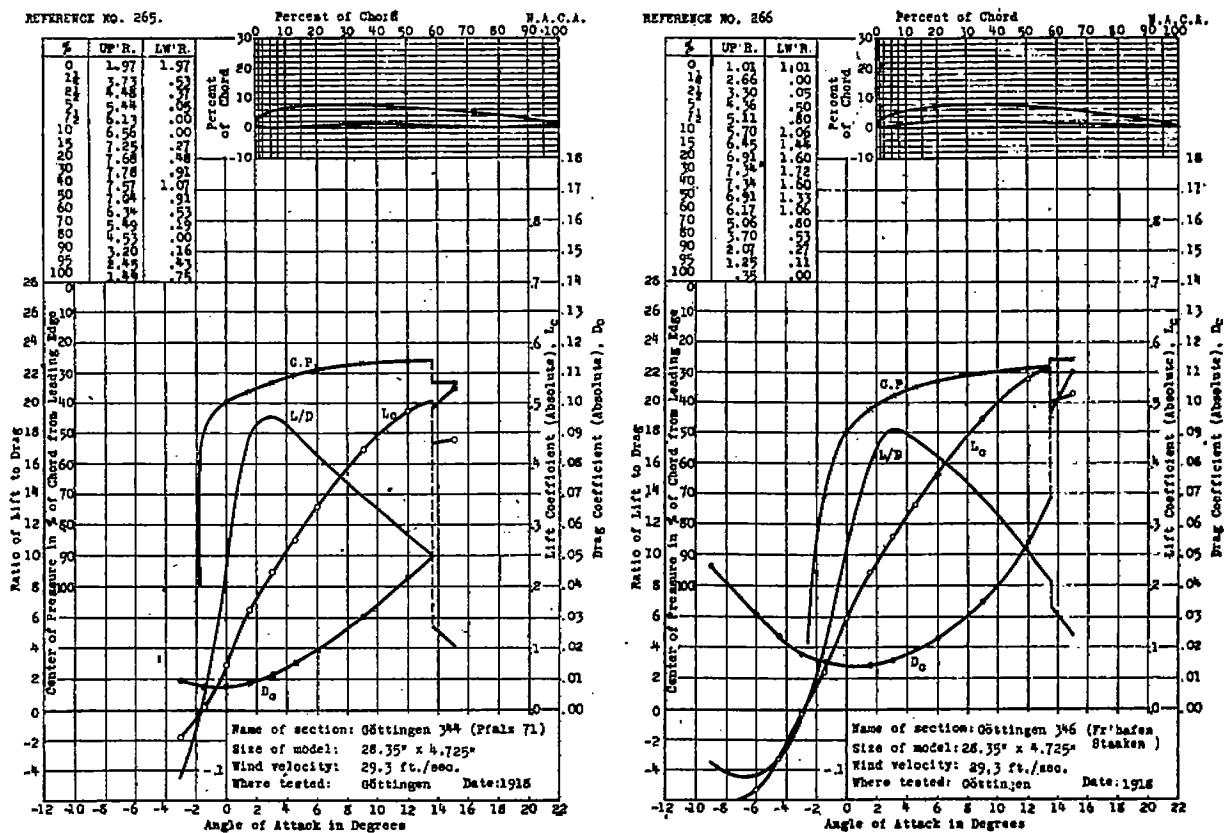
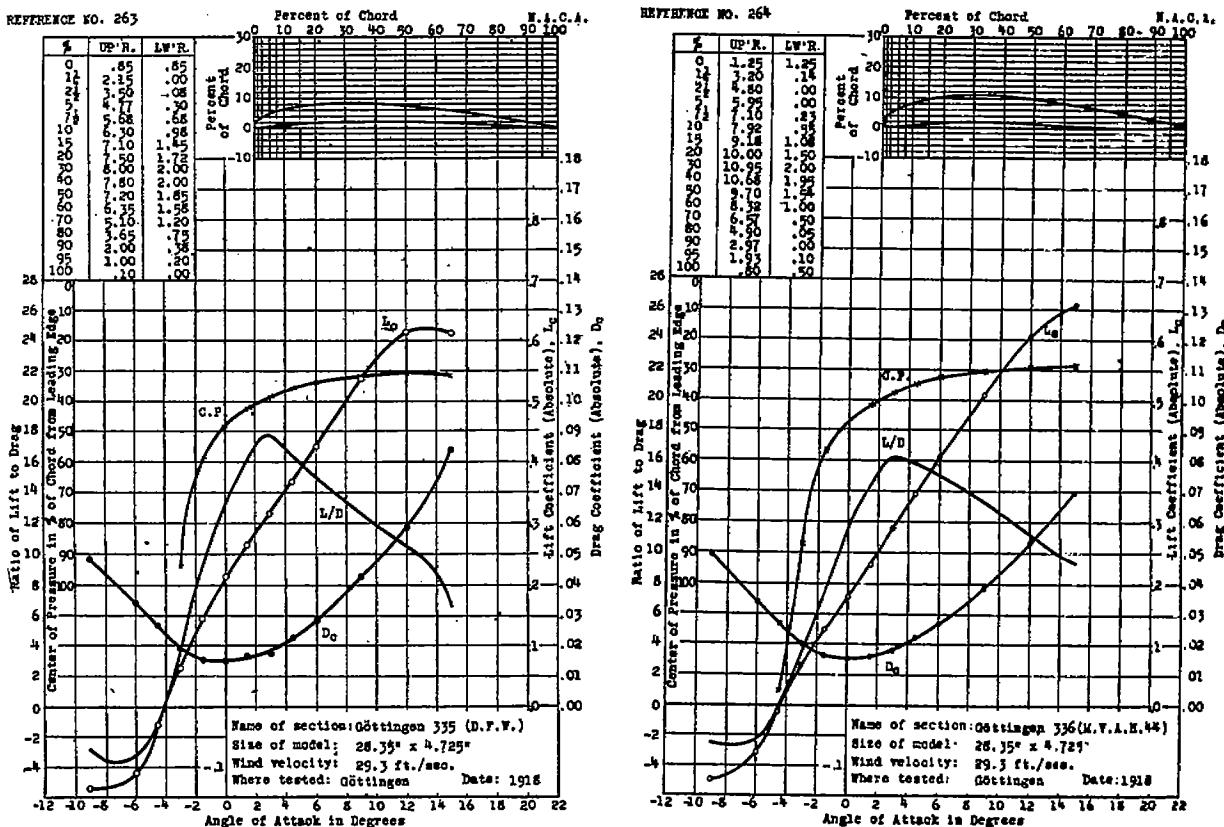


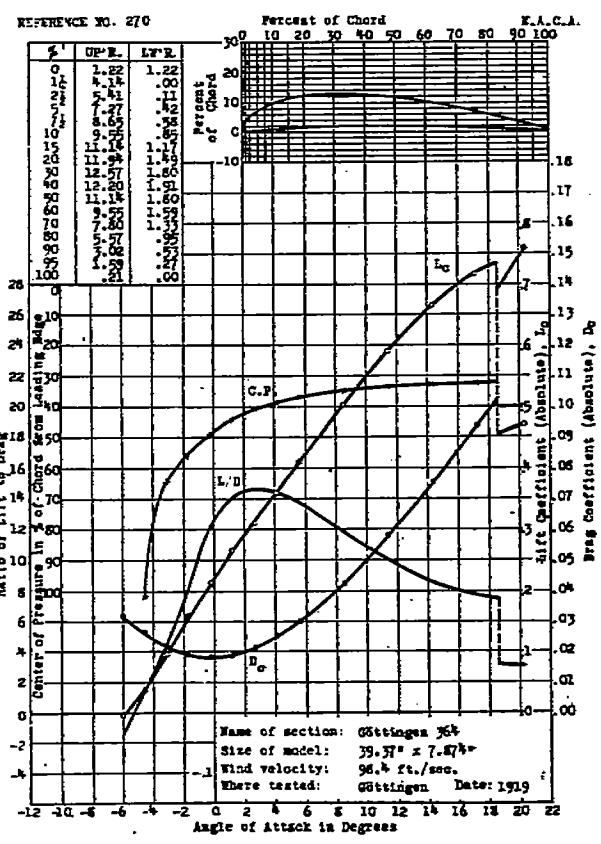
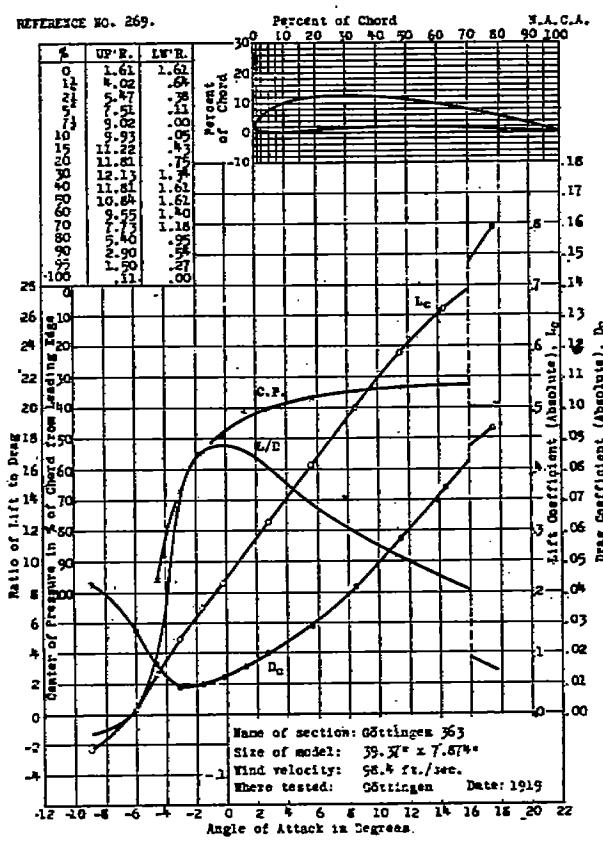
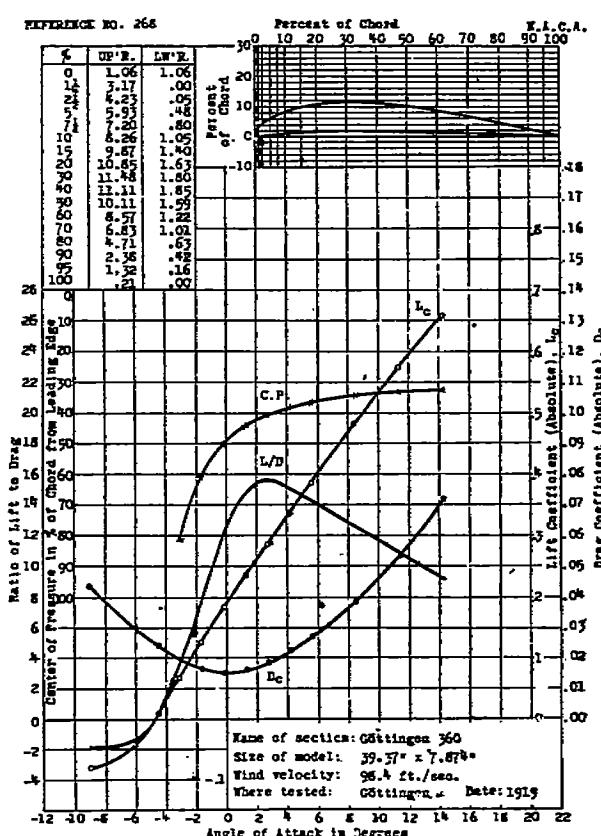
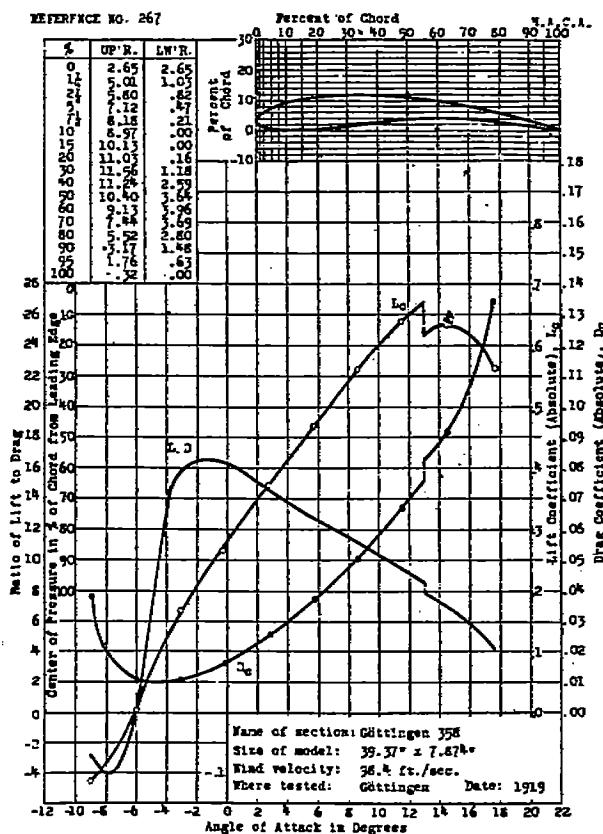




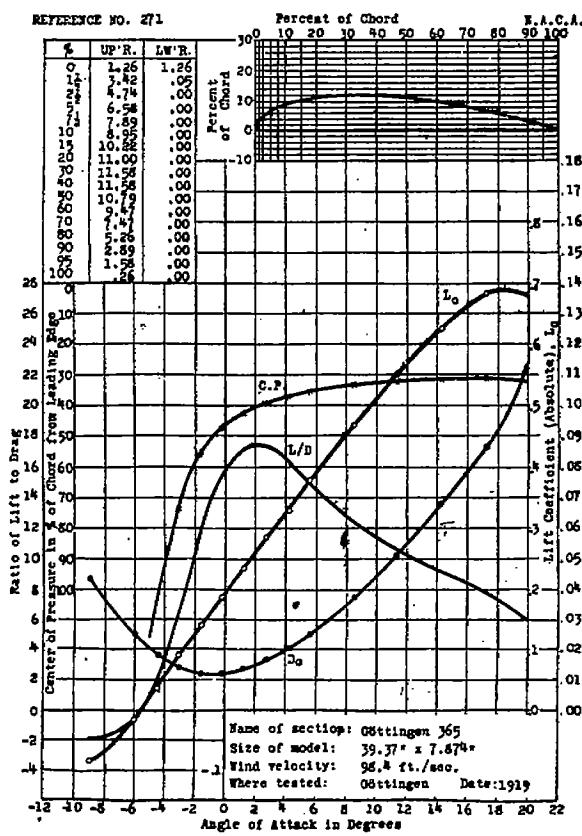




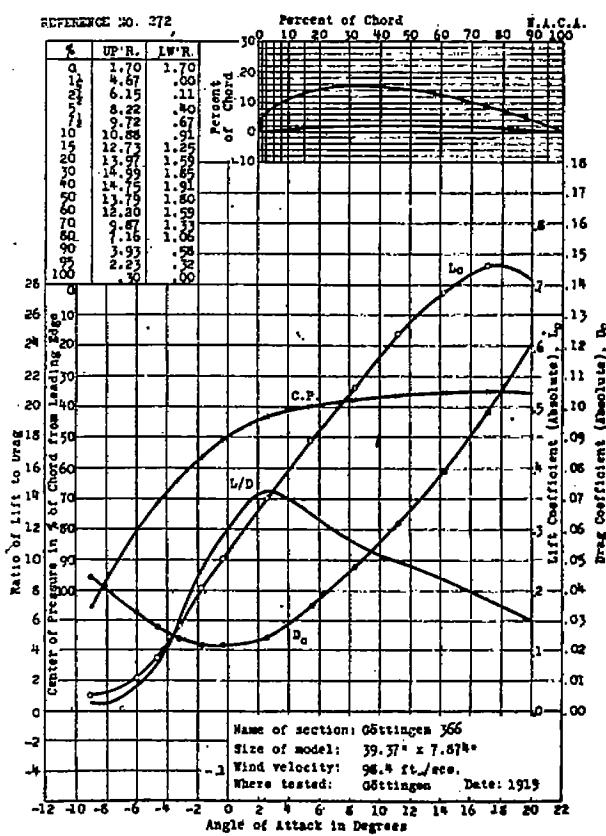




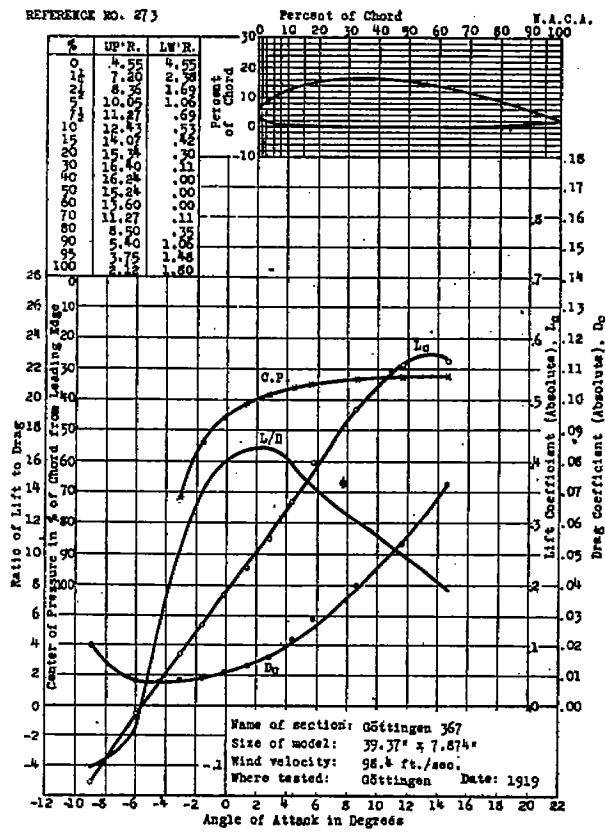
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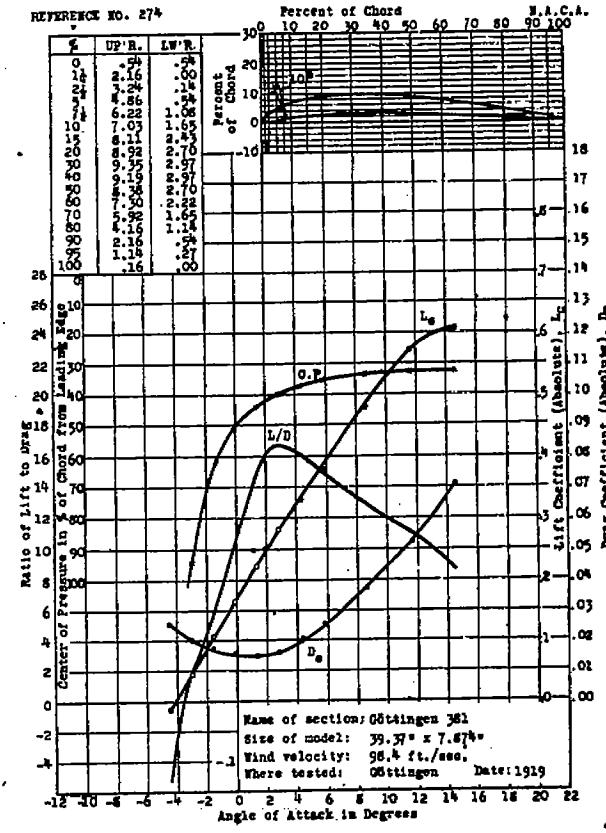
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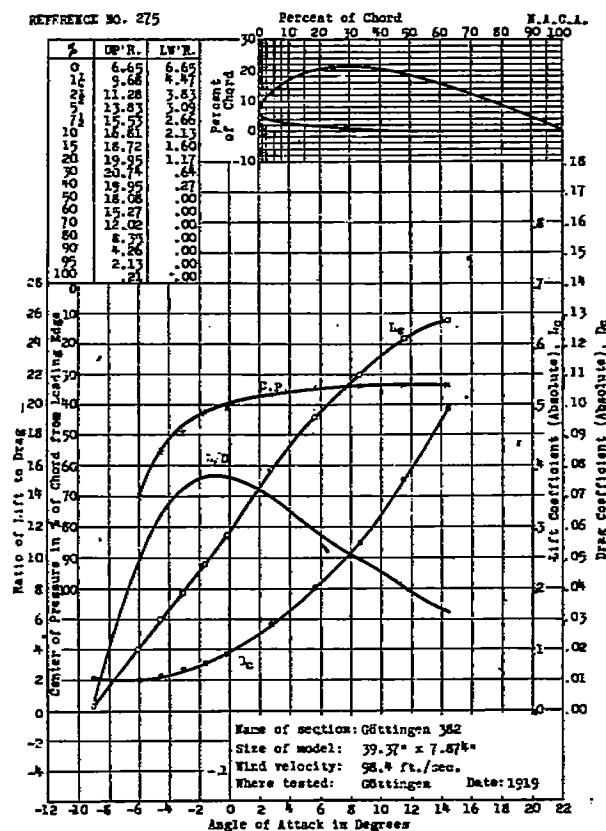
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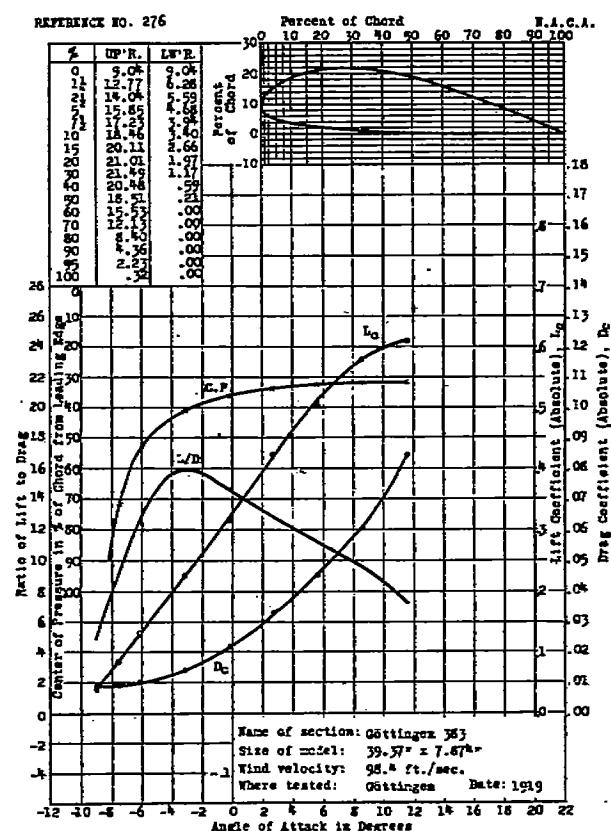
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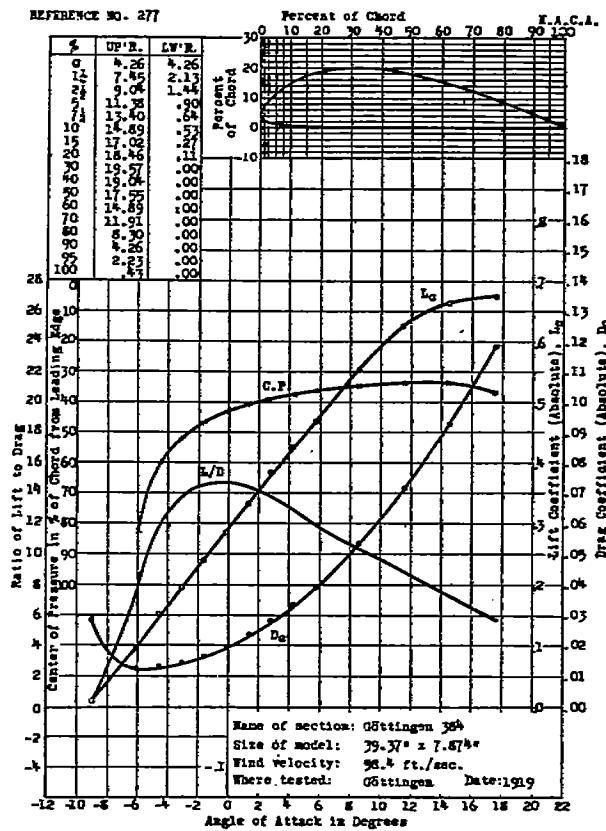
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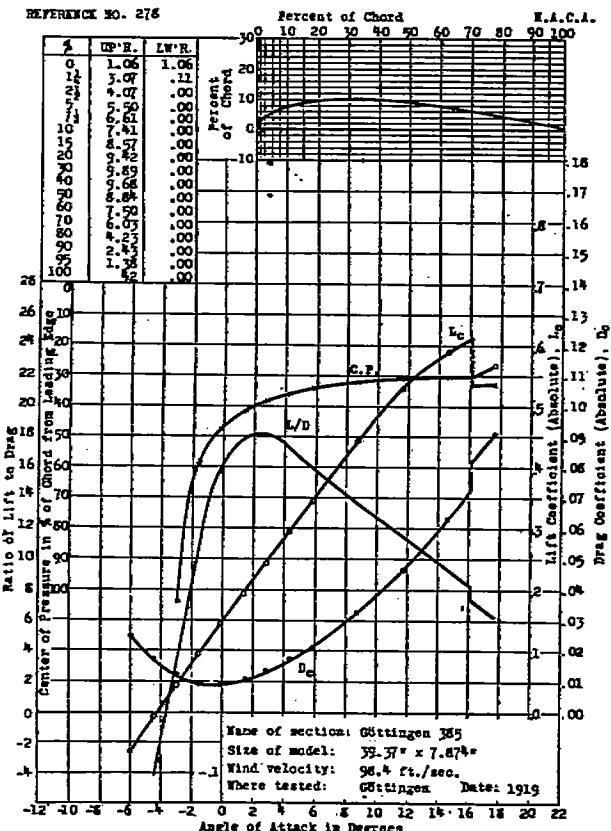
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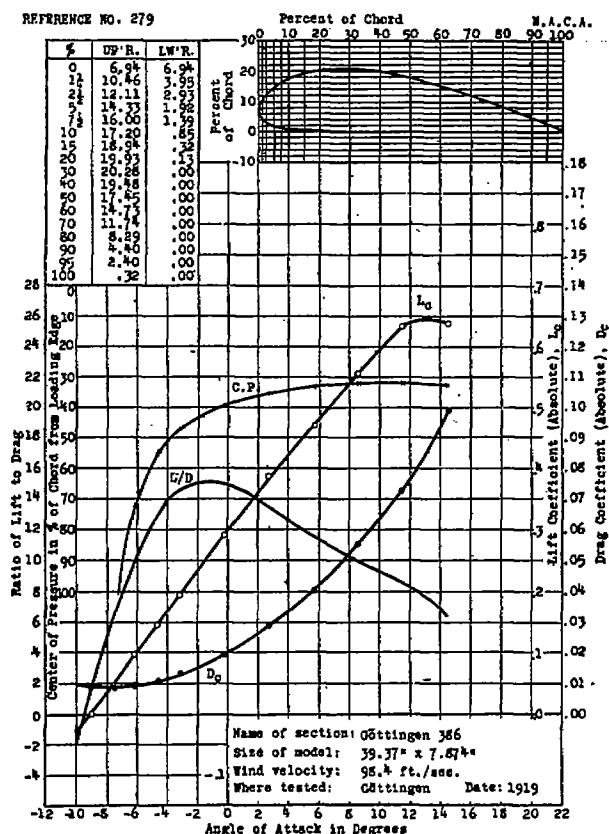
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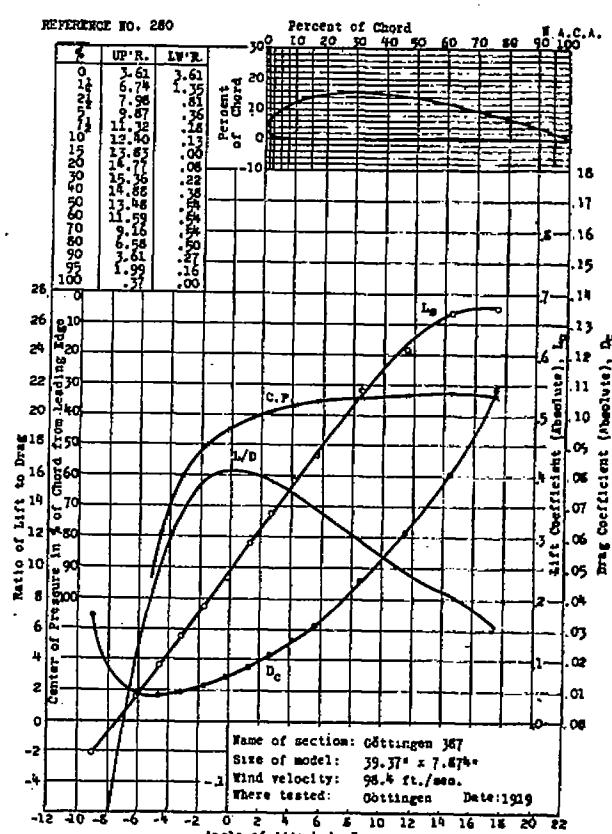
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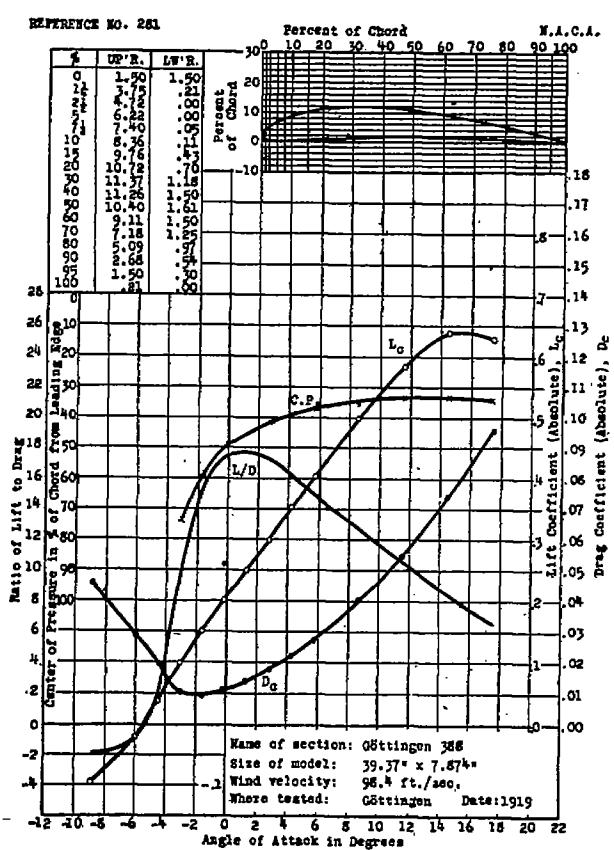
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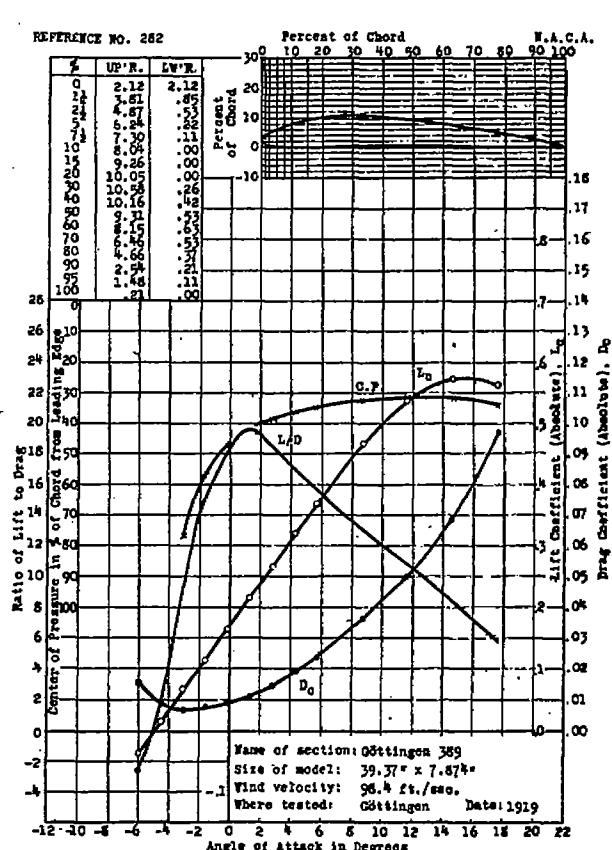
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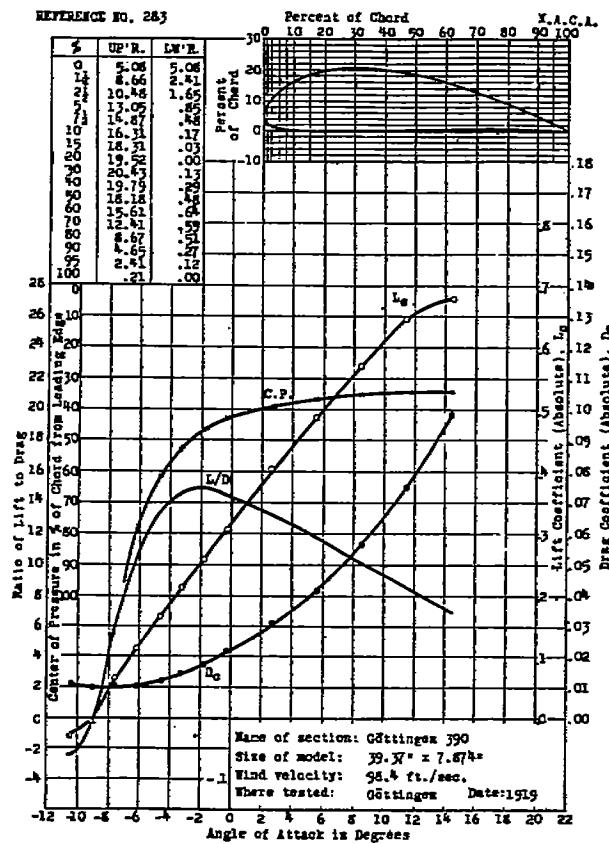
REFERENCE NO. 281



REFERENCE NO. 282



REFERENCE NO. 283



1

Angle of Attack in Degrees

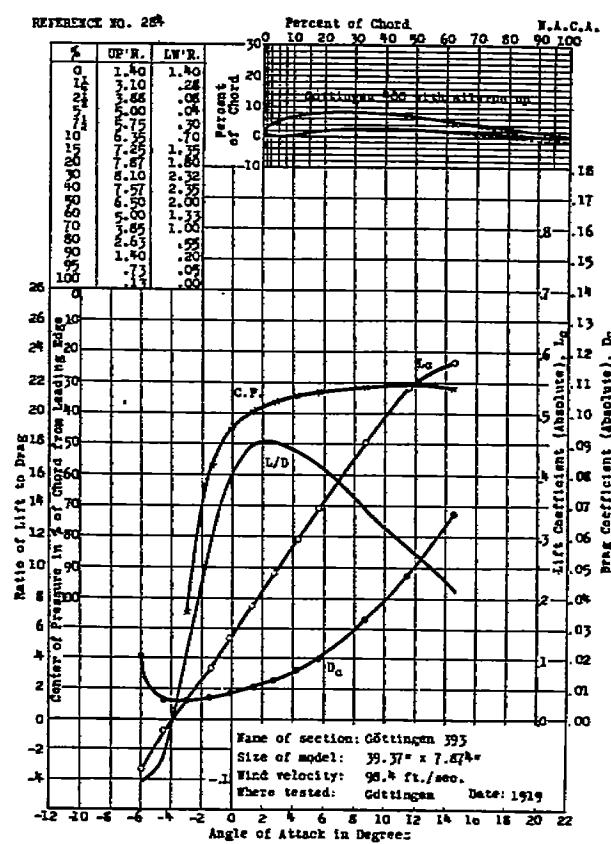
Name of section: Göttingen 390

Size of model: 39.37" x 7.874"

Wind velocity: 98.4 ft./sec.

Where tested: Göttingen Date: 1919

REFERENCE NO. 284



1

Angle of Attack in Degrees

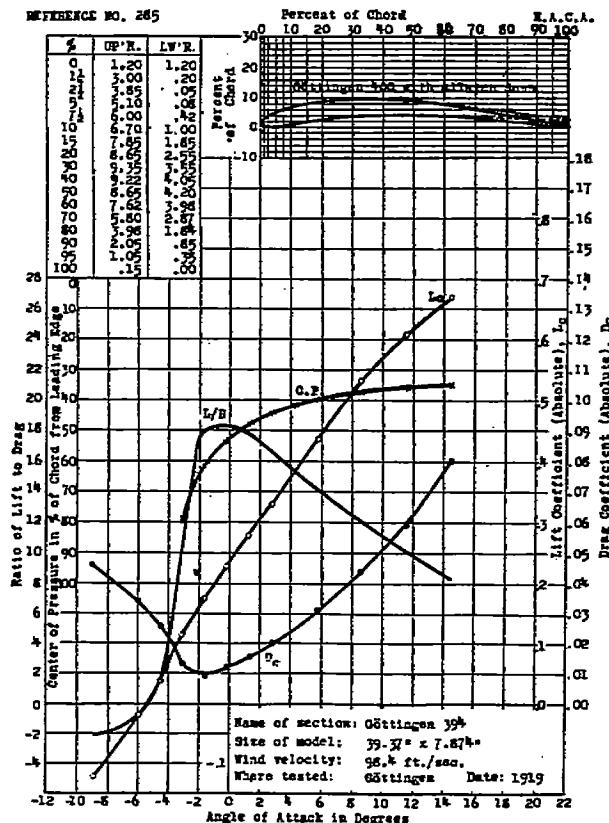
Name of section: Göttingen 393

Size of model: 39.37" x 7.874"

Wind velocity: 98.4 ft./sec.

Where tested: Göttingen Date: 1919

REFERENCE NO. 285



1

Angle of Attack in Degrees

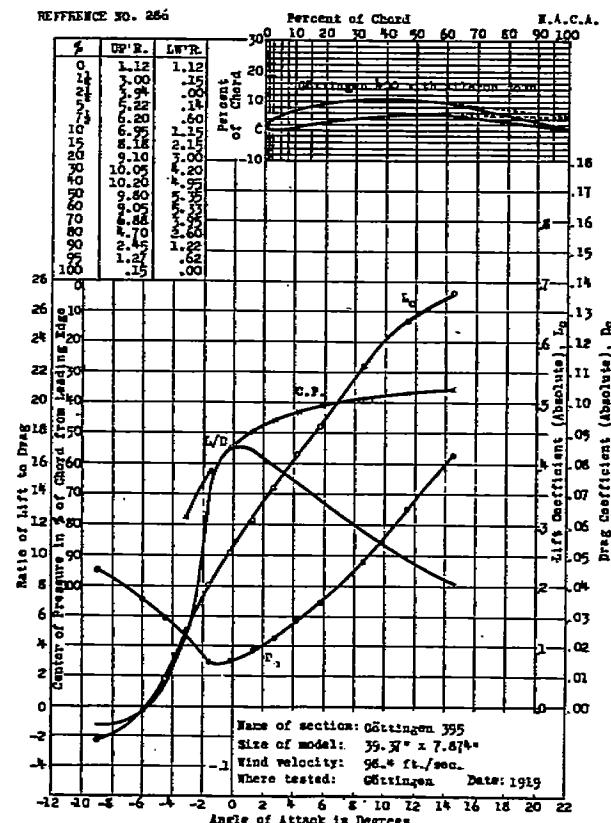
Name of section: Göttingen 394

Size of model: 39.37" x 7.874"

Wind velocity: 98.4 ft./sec.

Where tested: Göttingen Date: 1919

REFERENCE NO. 286



1

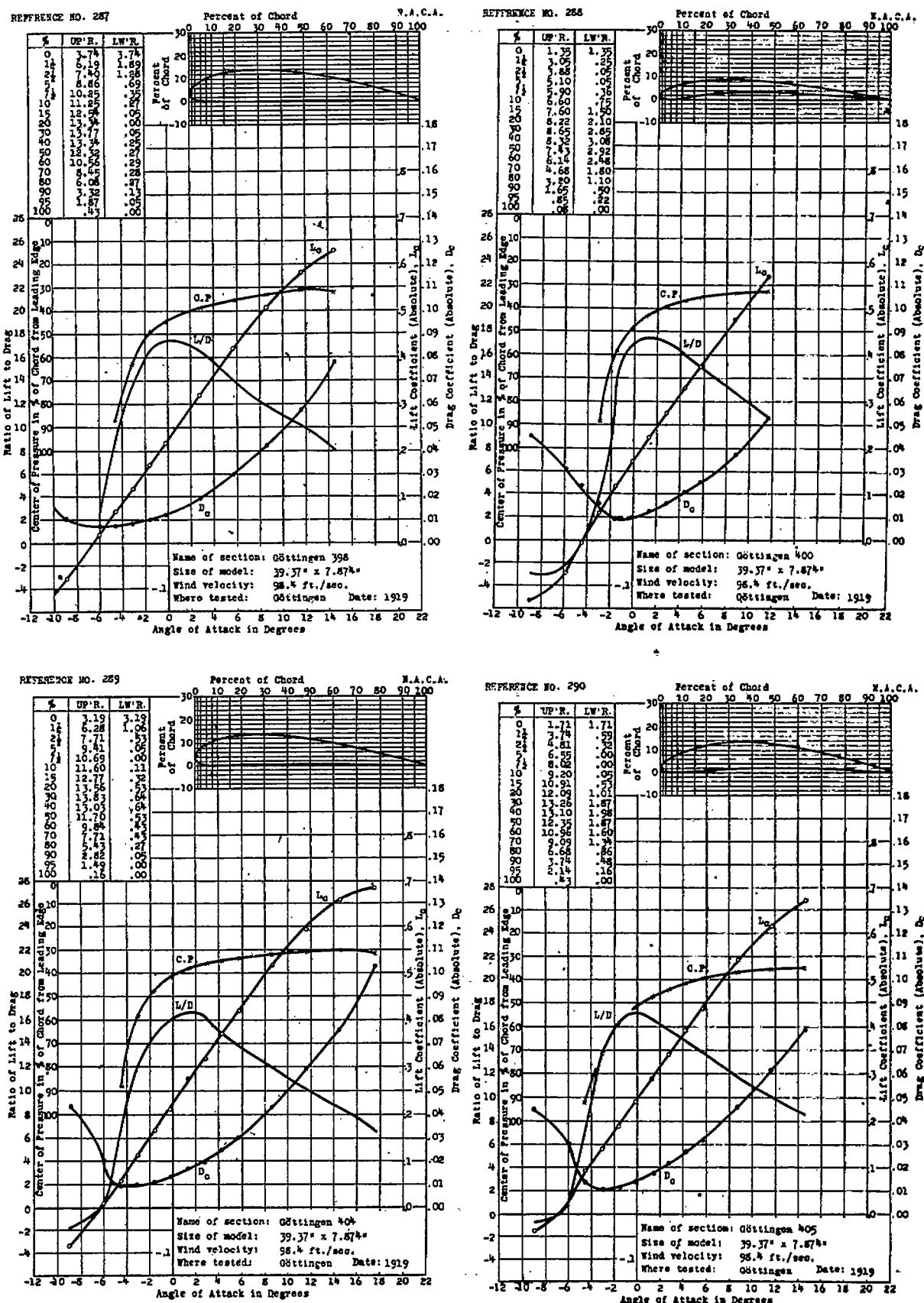
Angle of Attack in Degrees

Name of section: Göttingen 395

Size of model: 39.37" x 7.874"

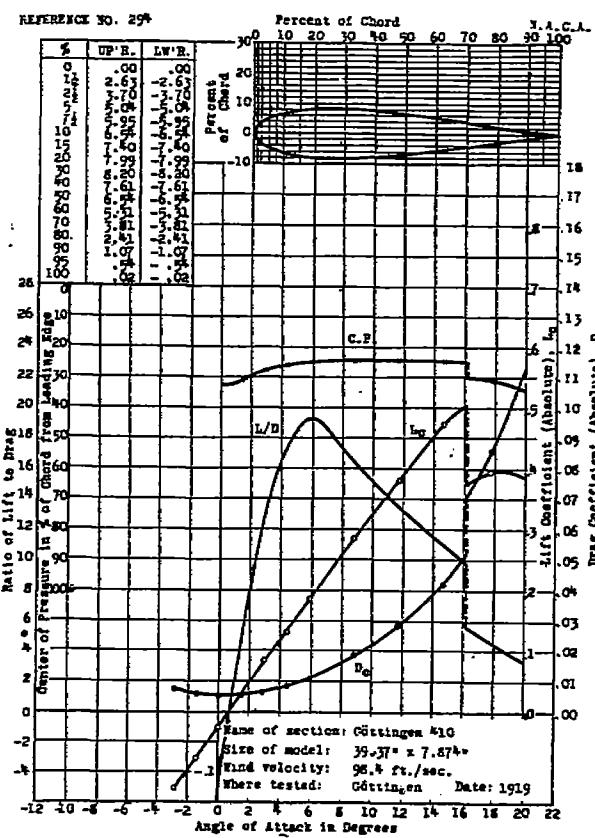
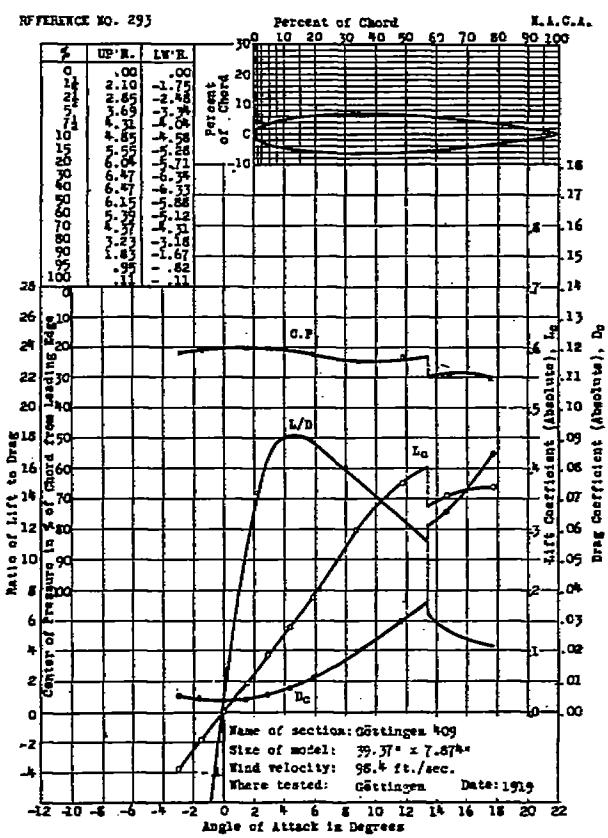
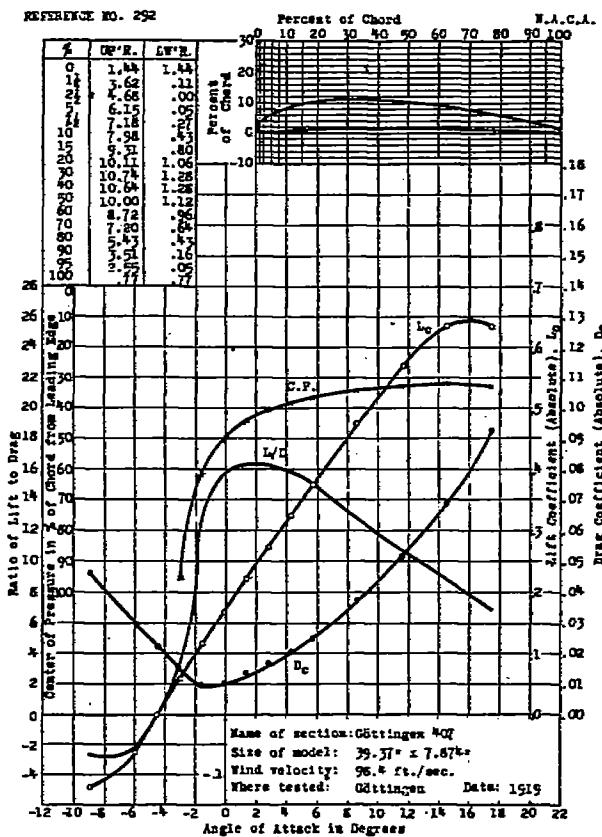
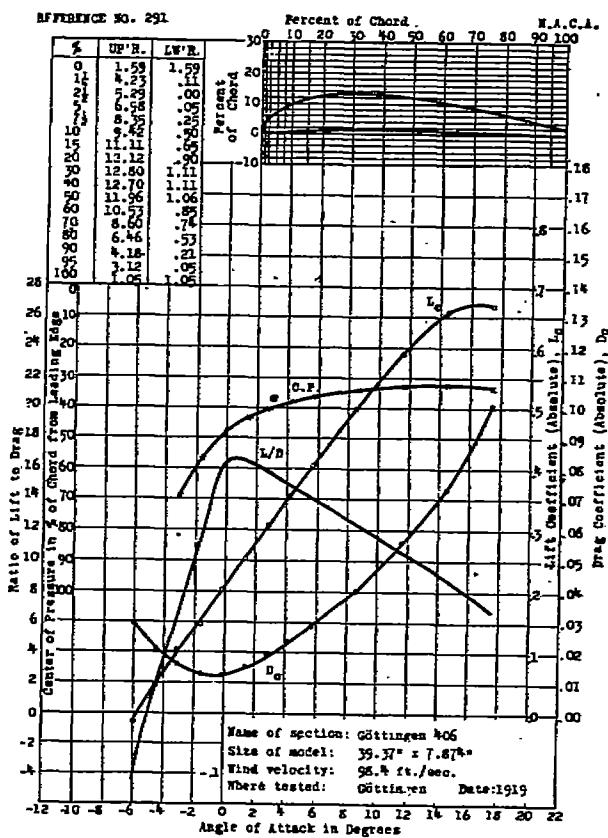
Wind velocity: 98.4 ft./sec.

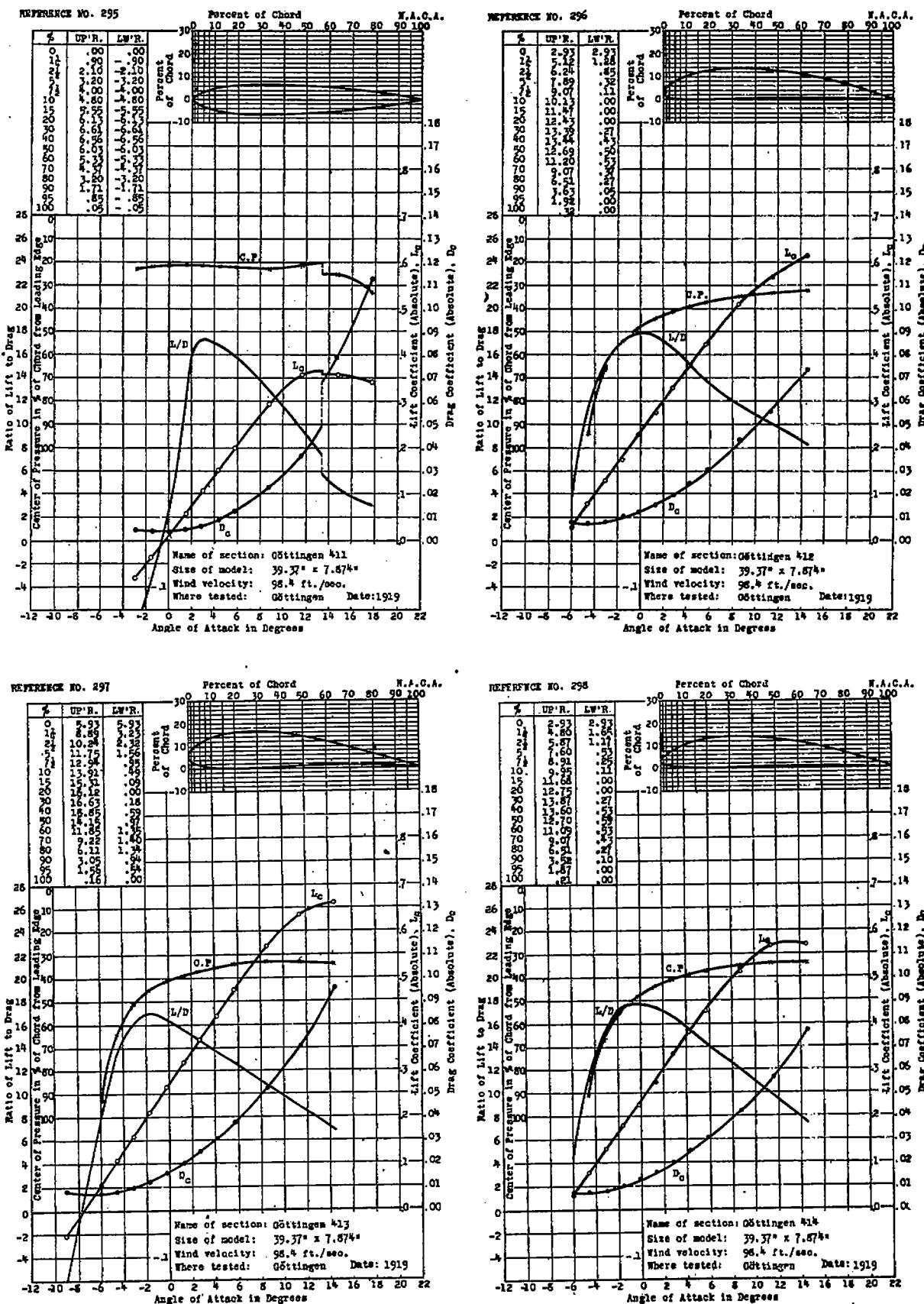
Where tested: Göttingen Date: 1919

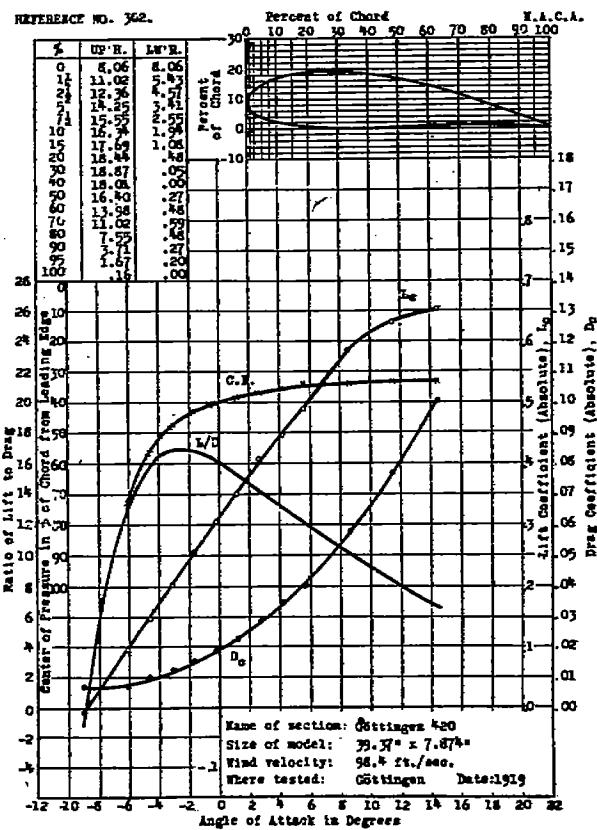
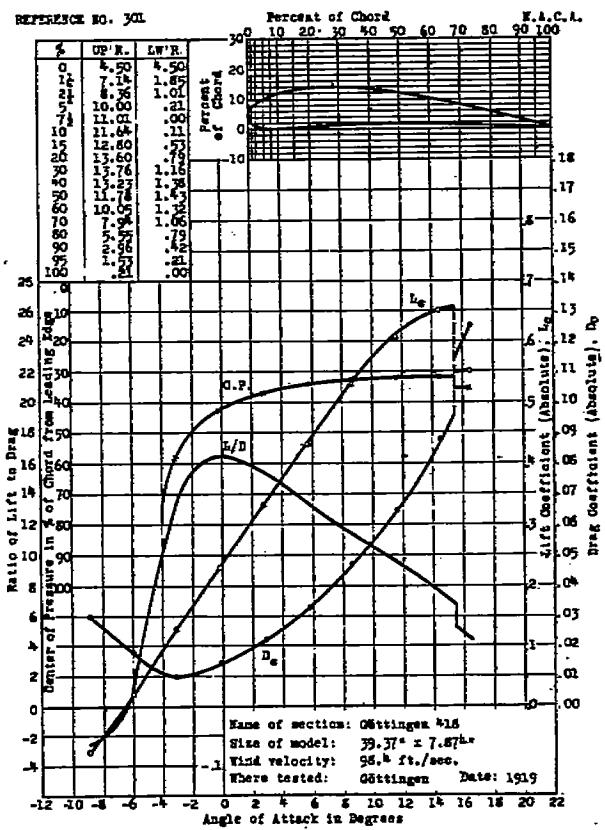
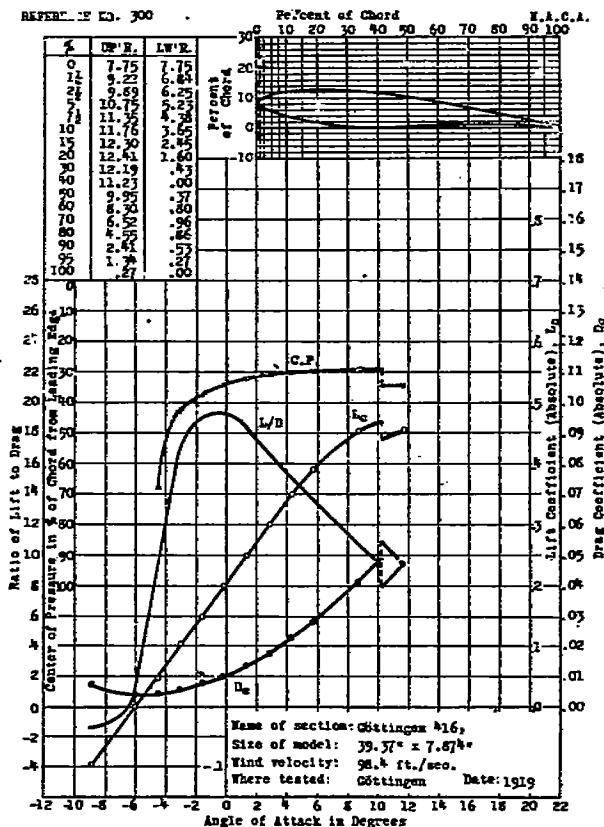
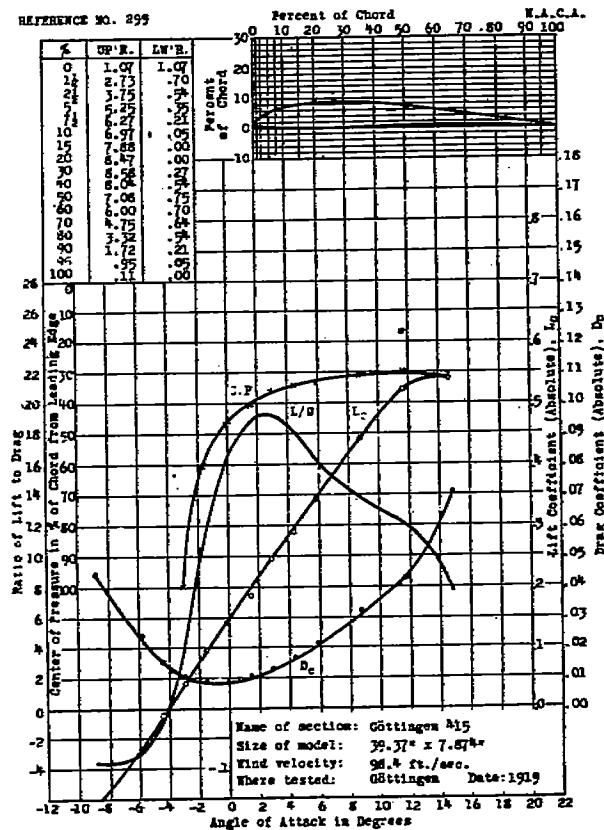


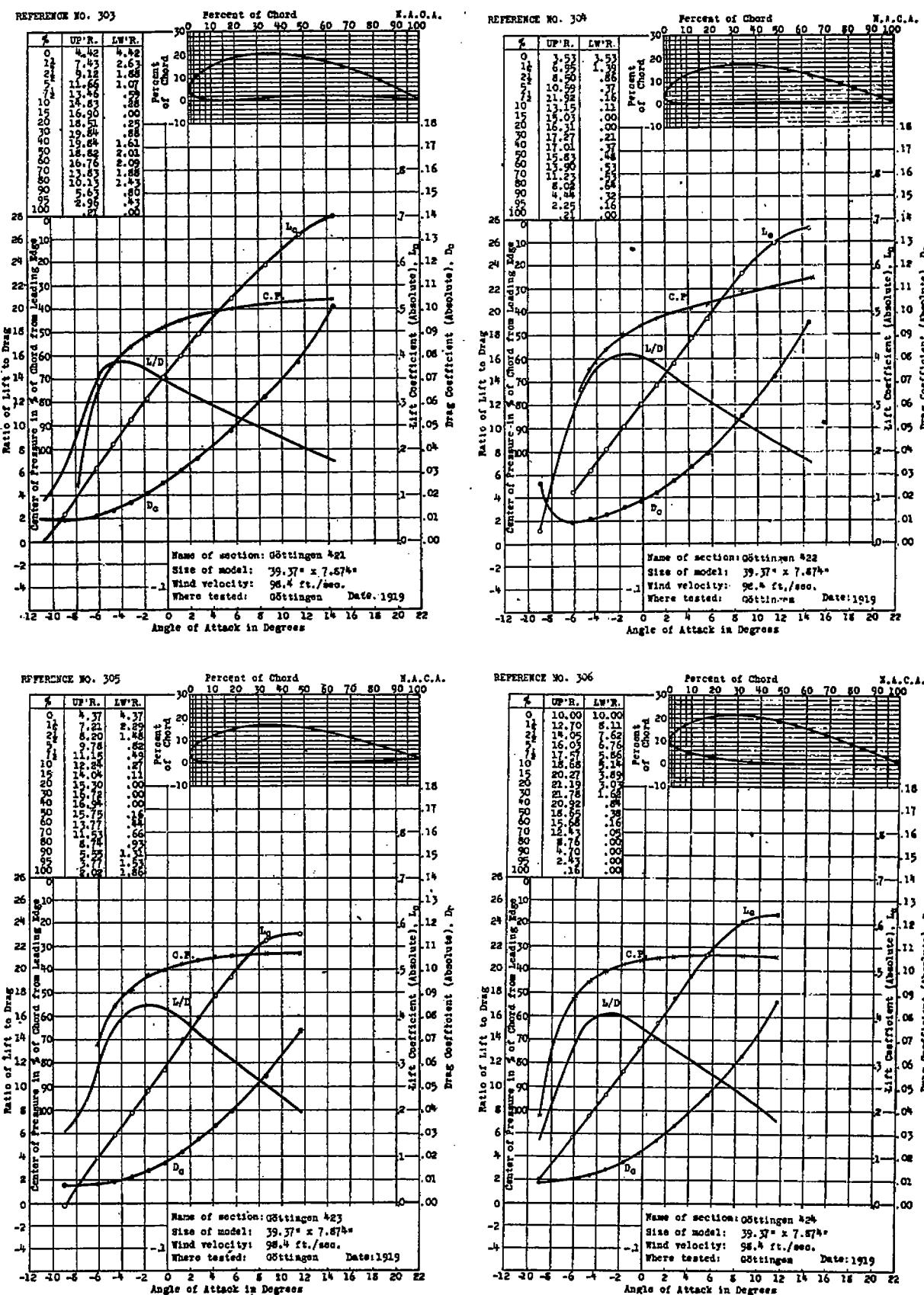
AERODYNAMIC CHARACTERISTICS OF AEROFOILS—II.

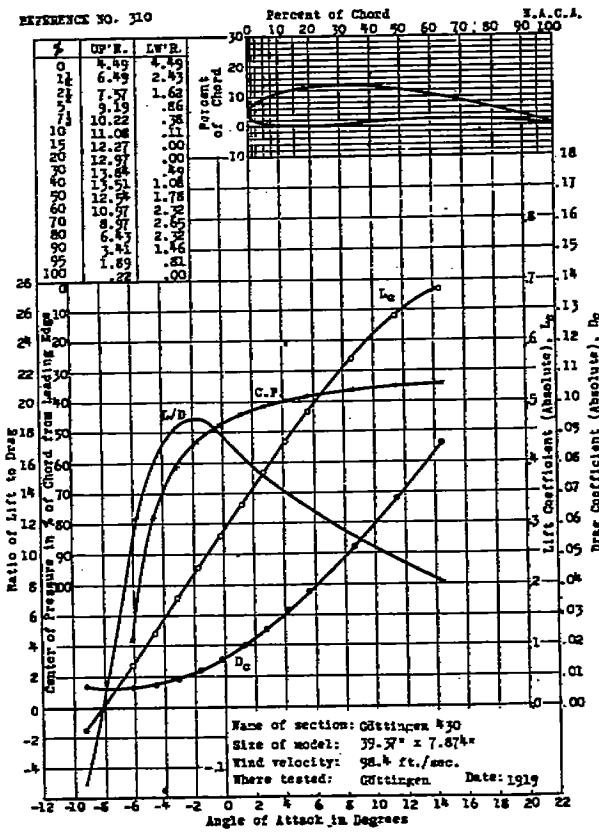
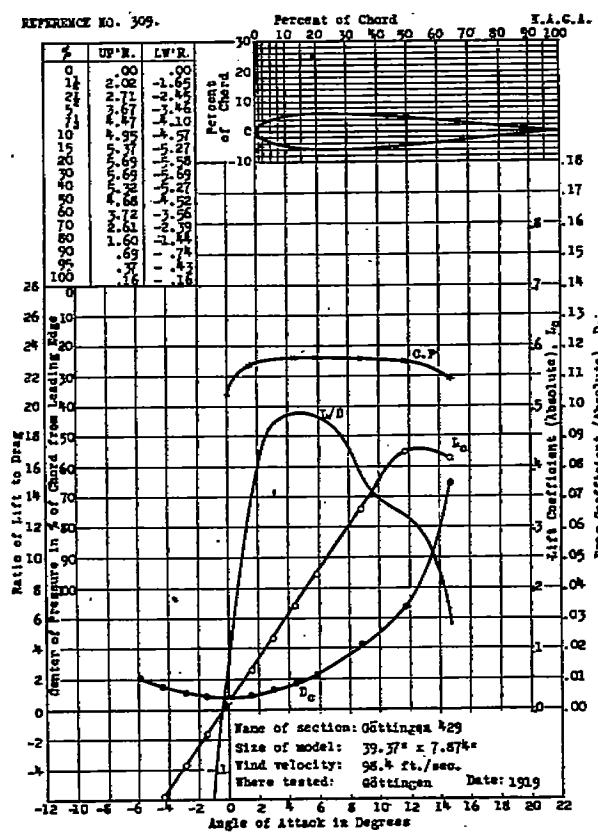
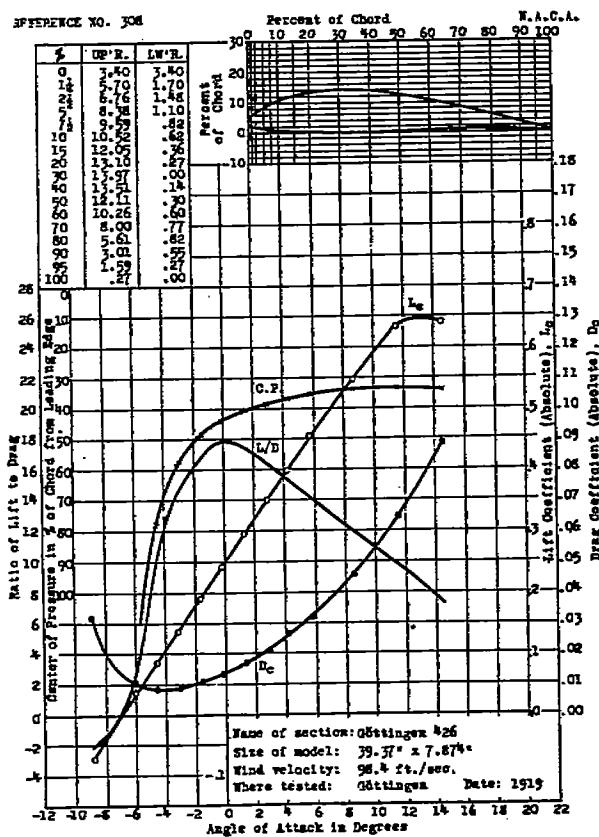
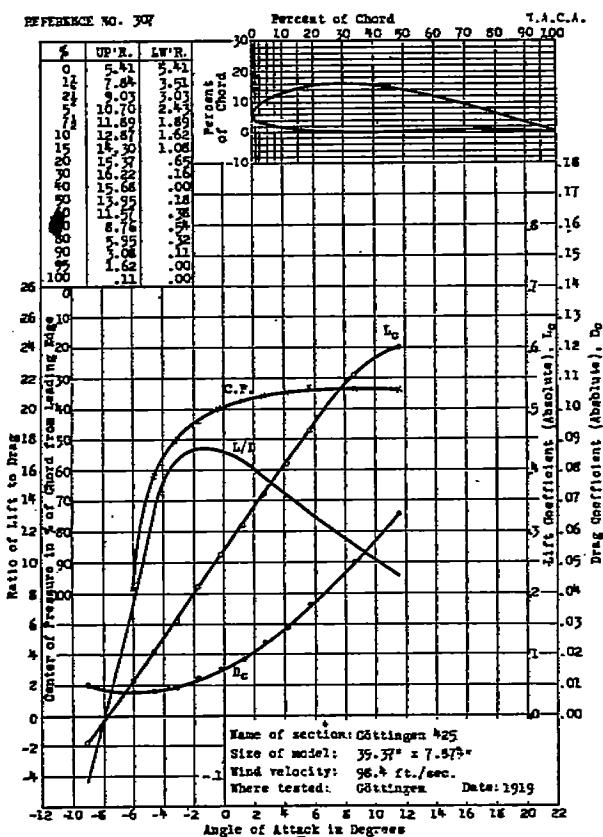
449

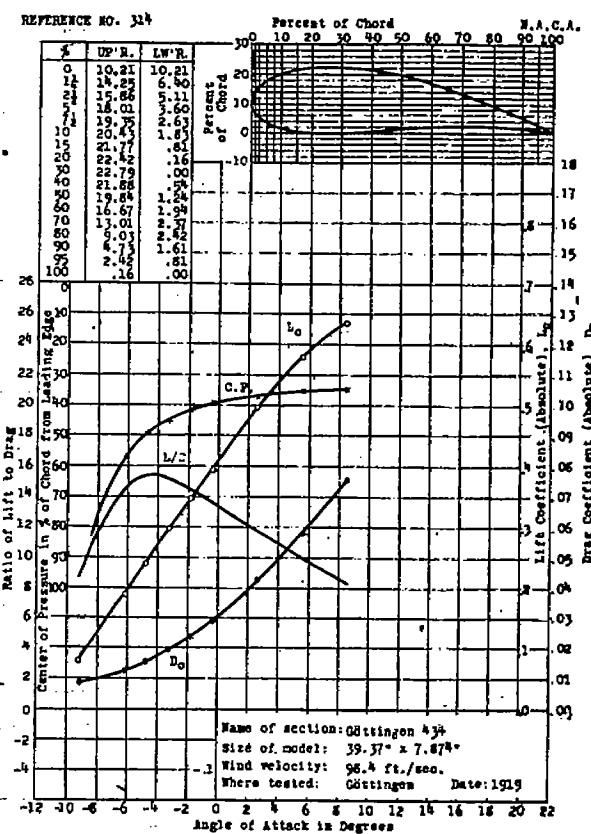
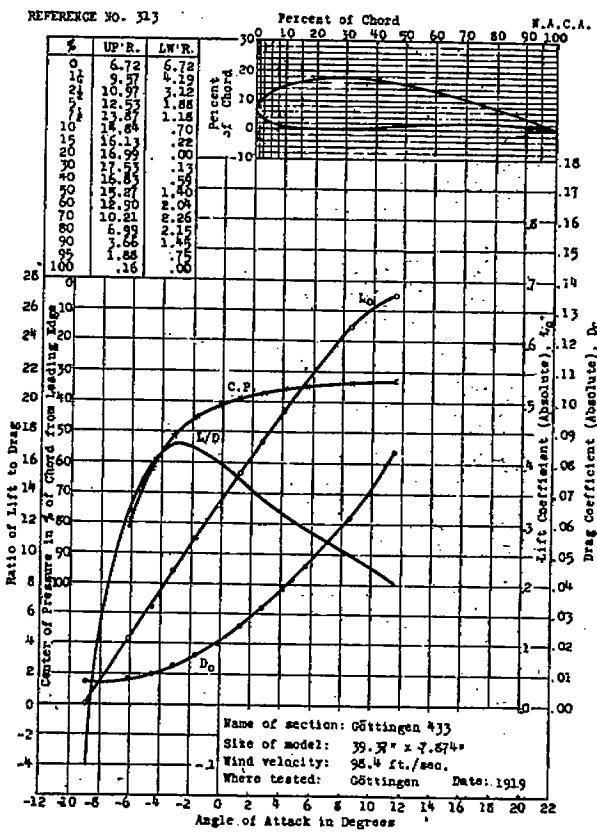
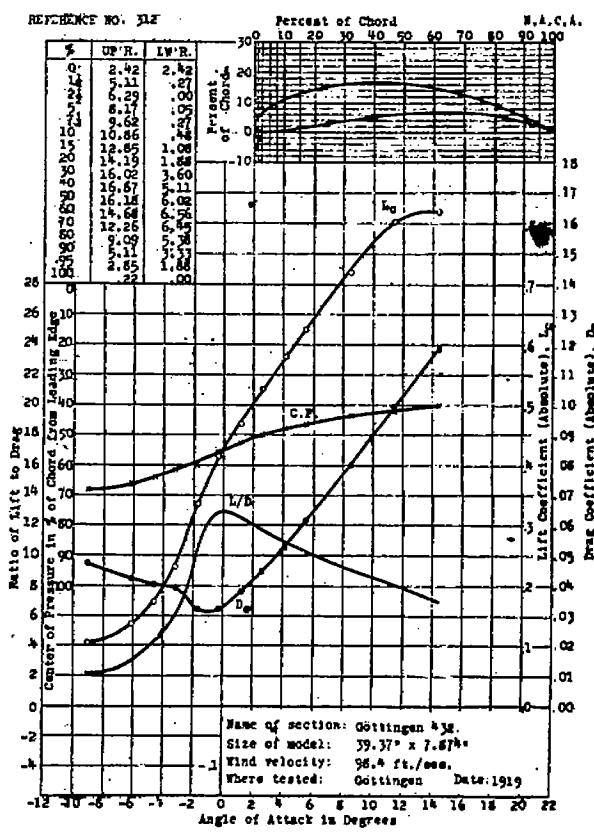
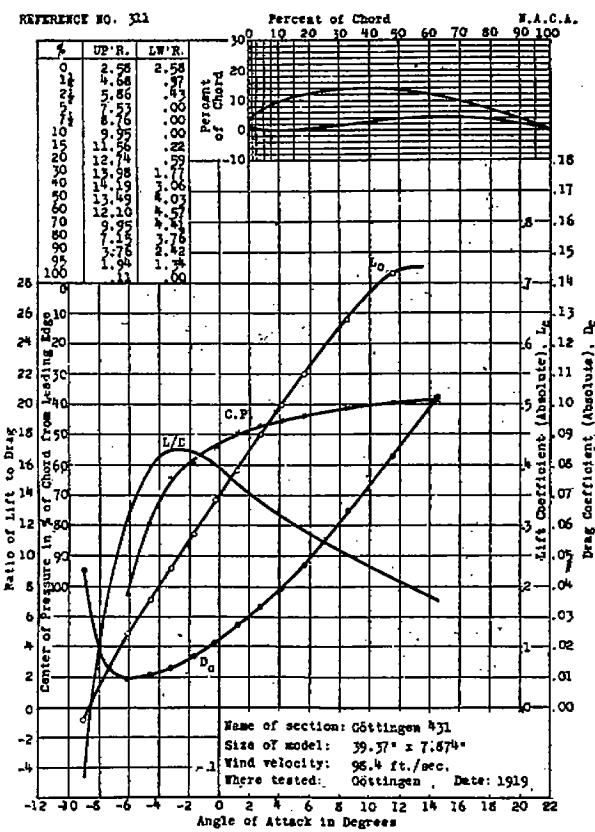


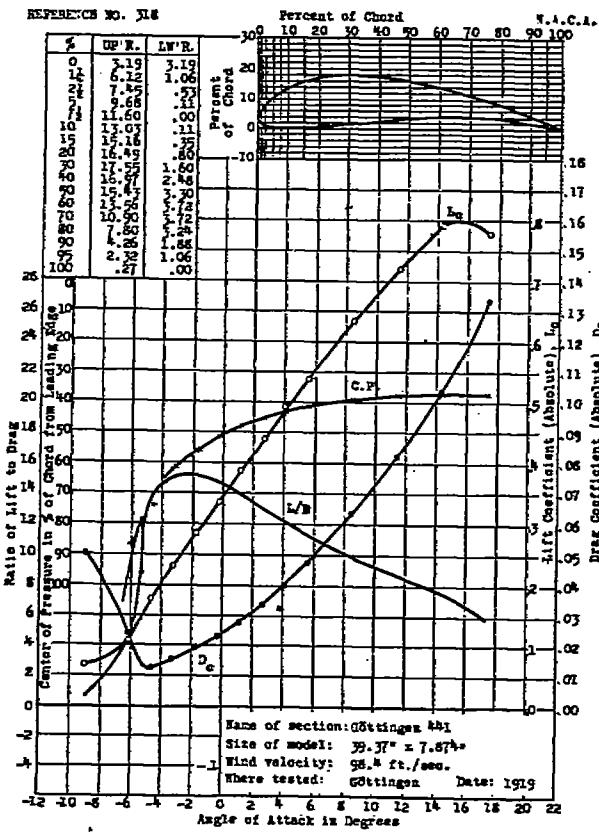
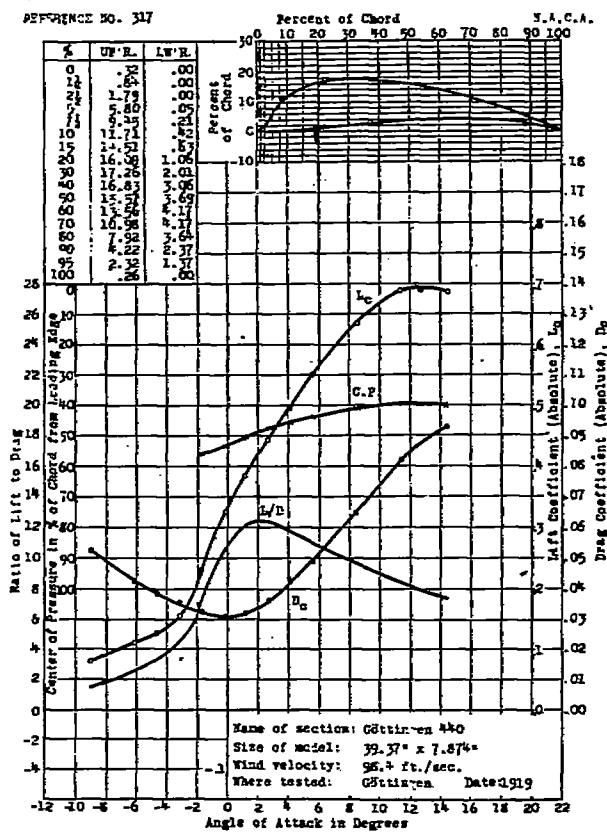
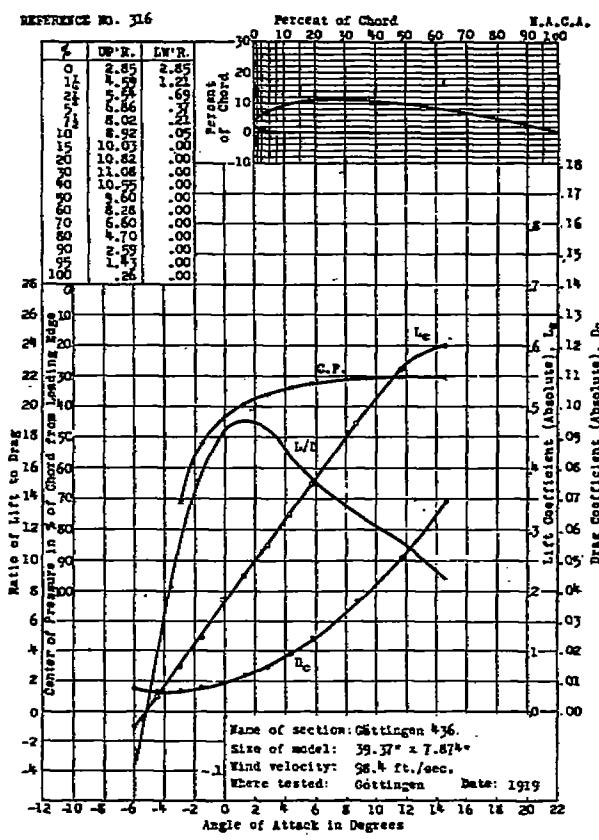
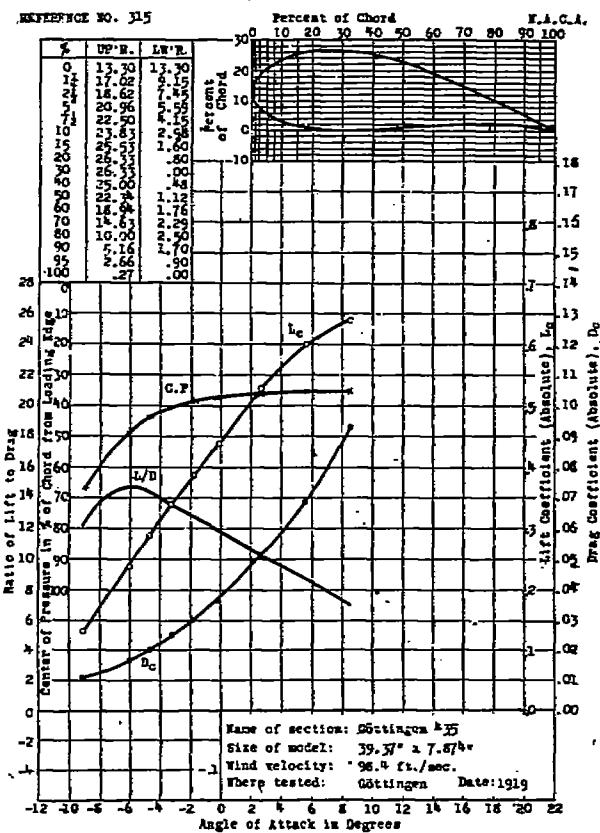


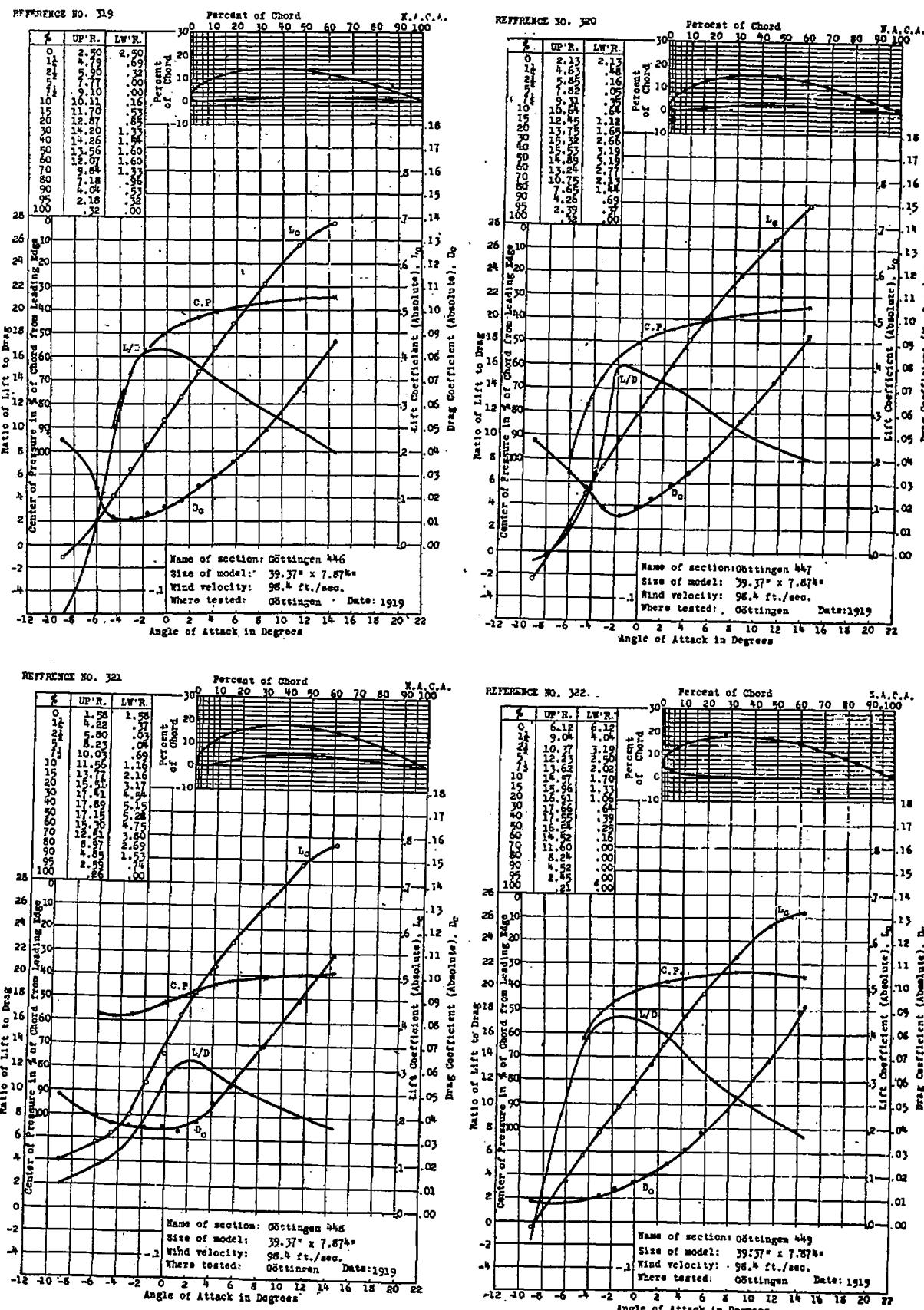




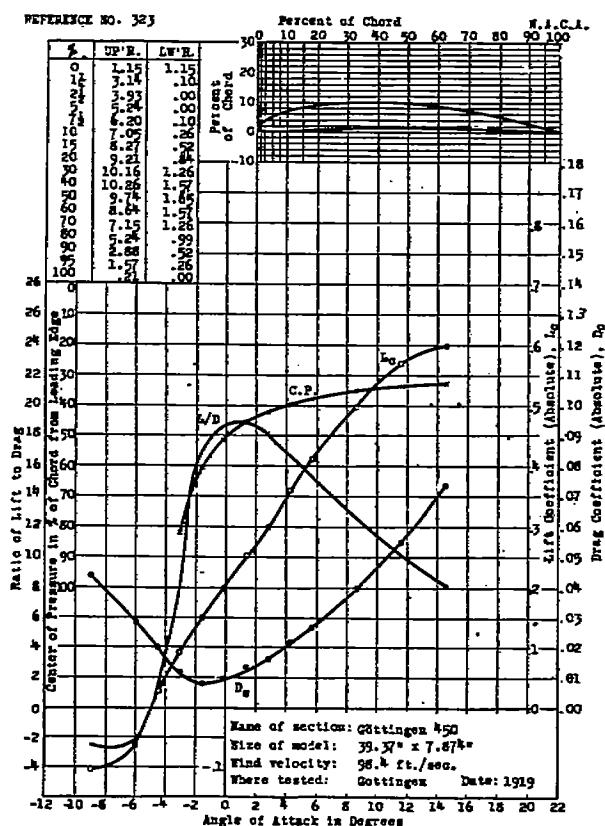




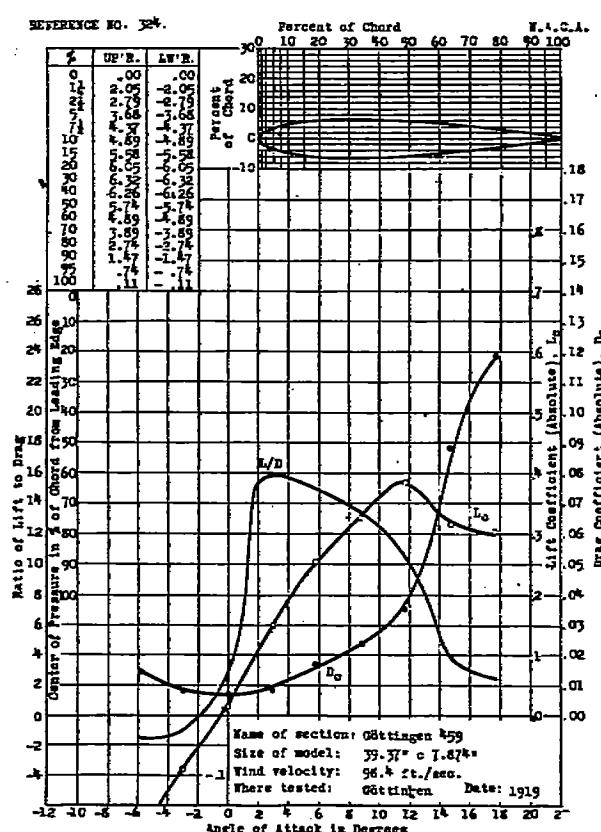




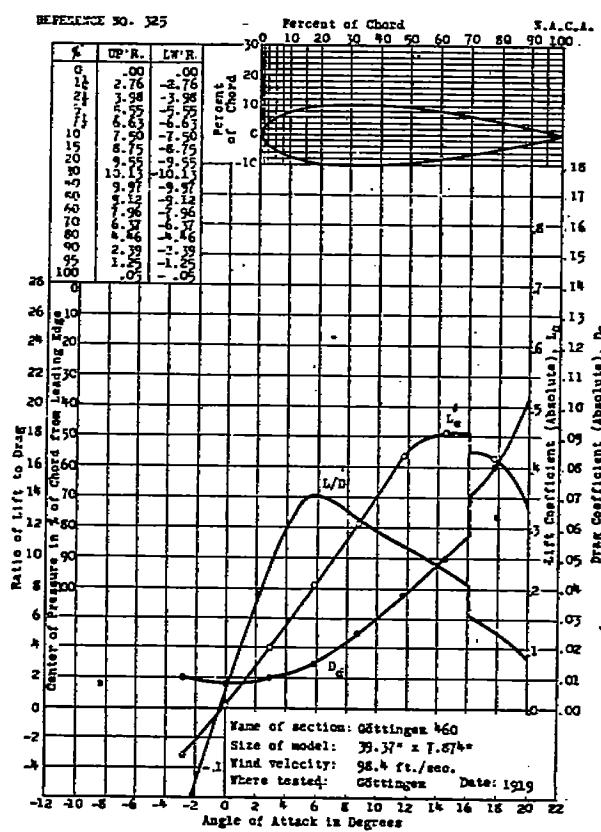
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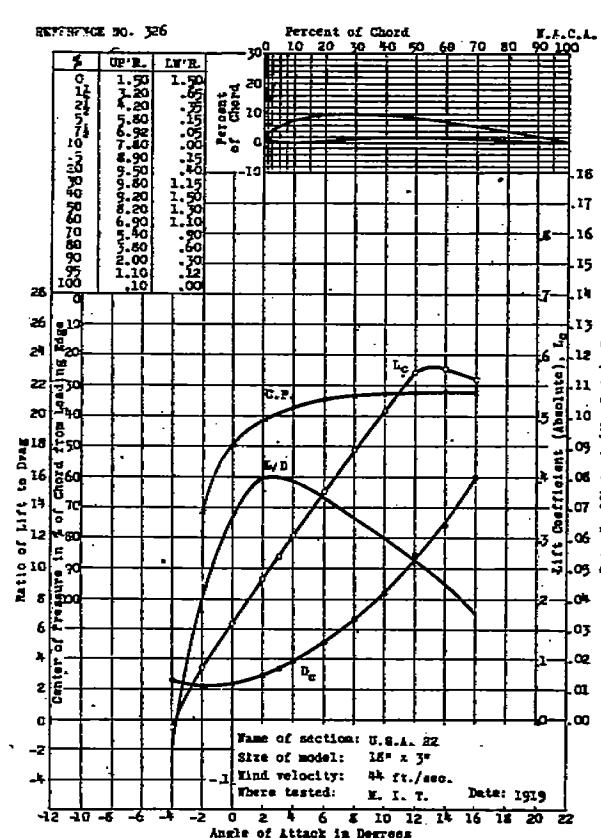
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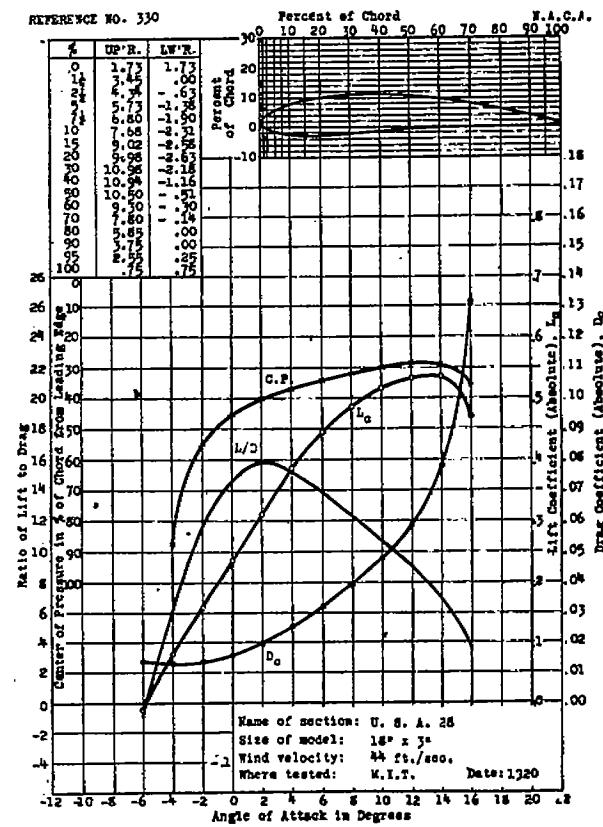
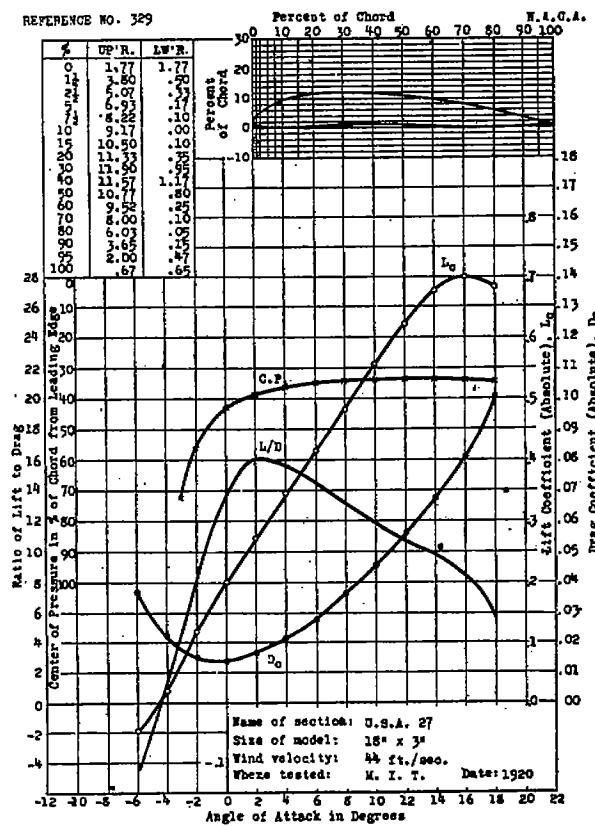
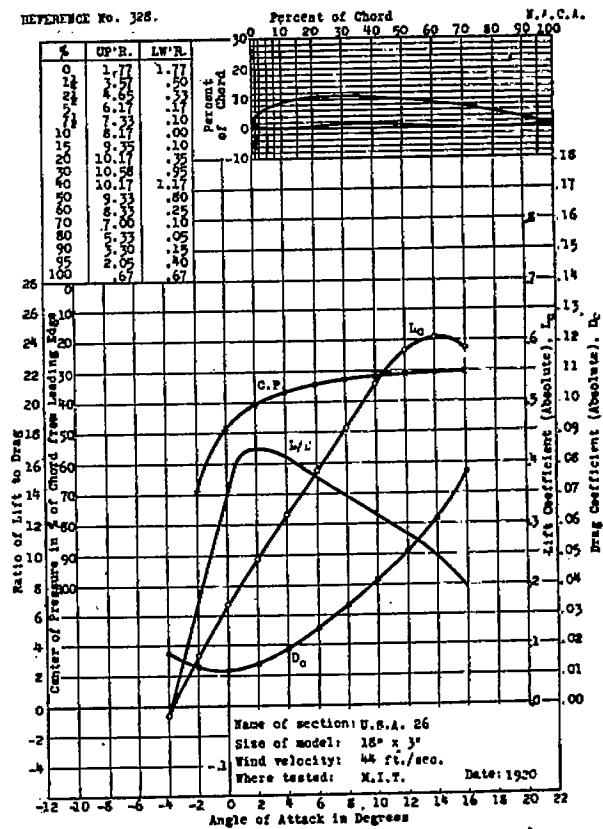
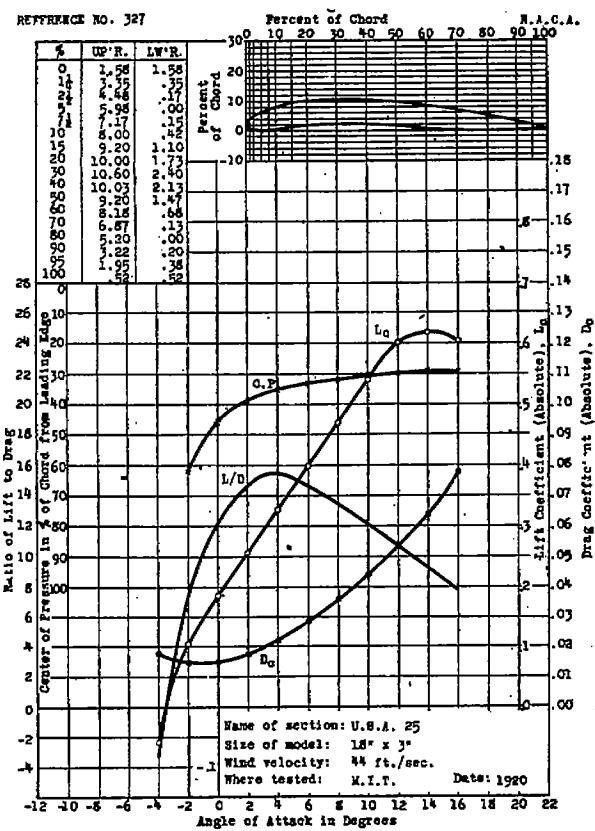


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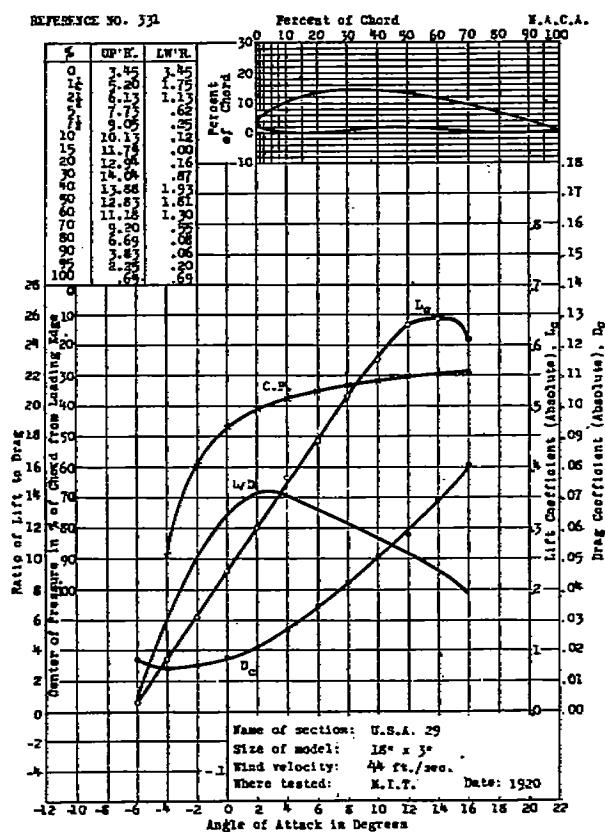


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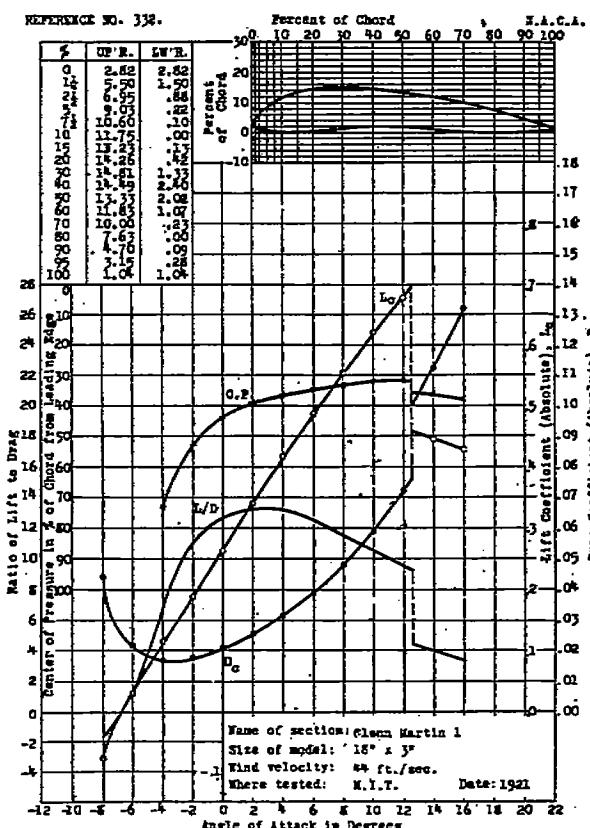




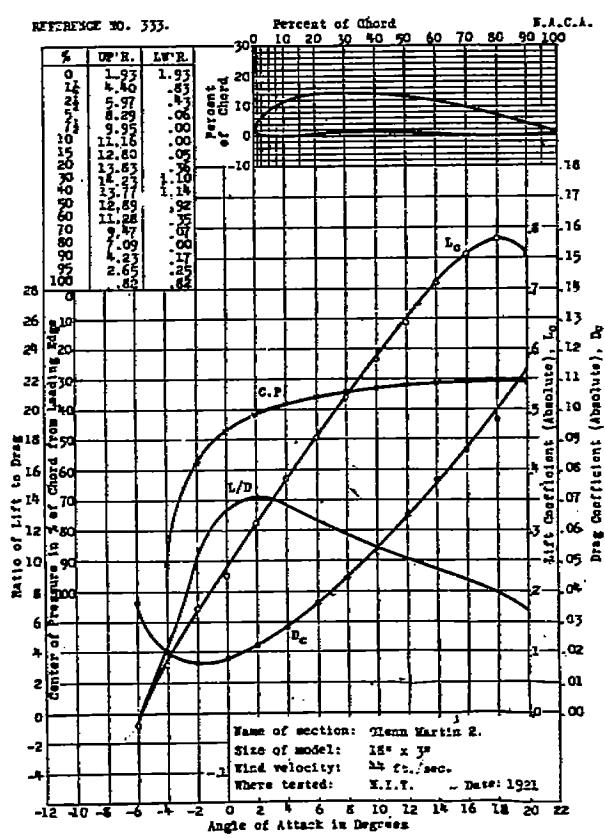
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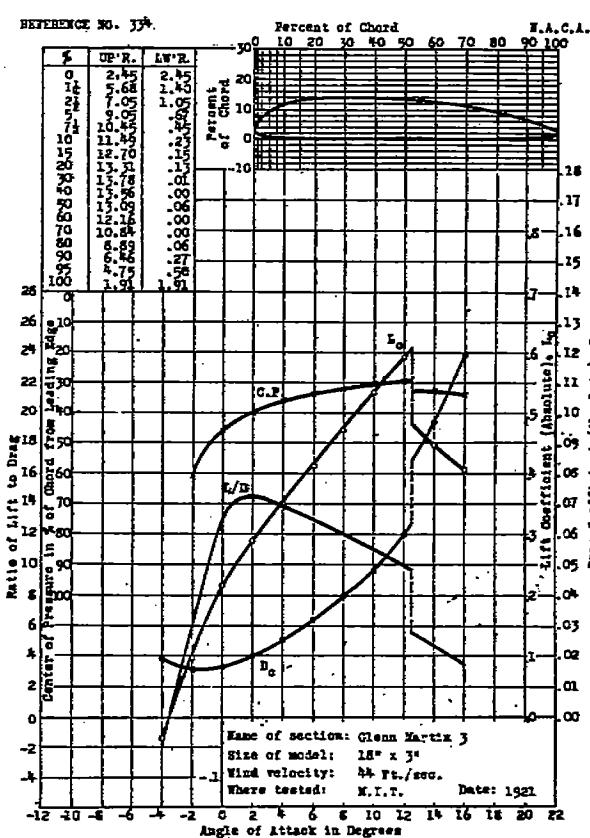
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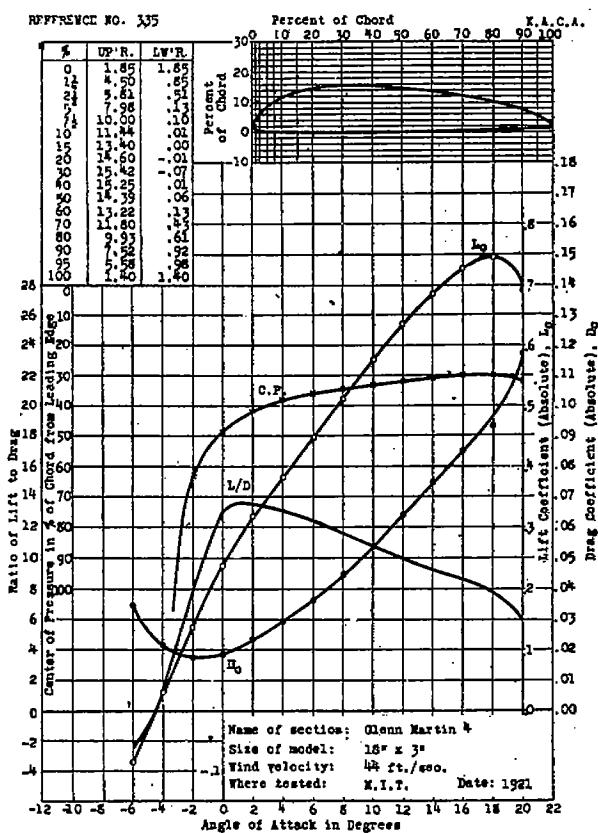
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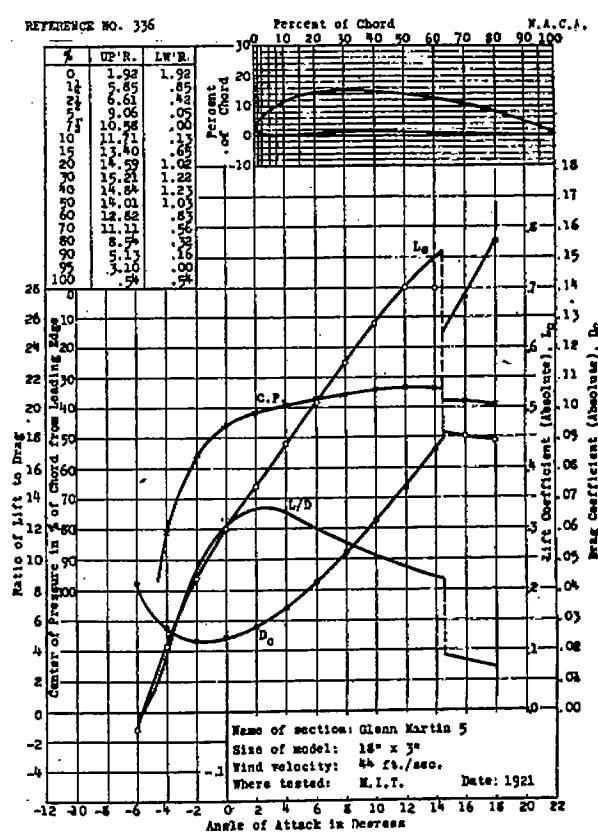
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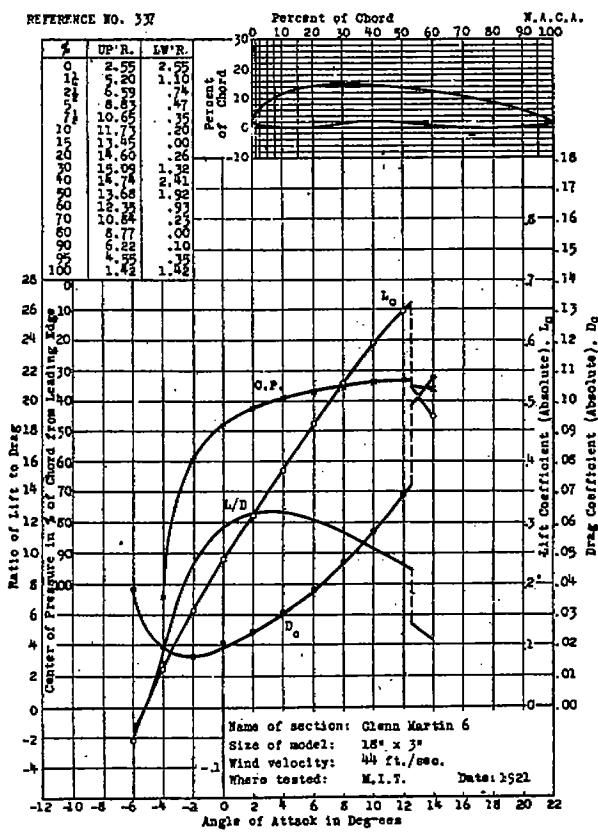
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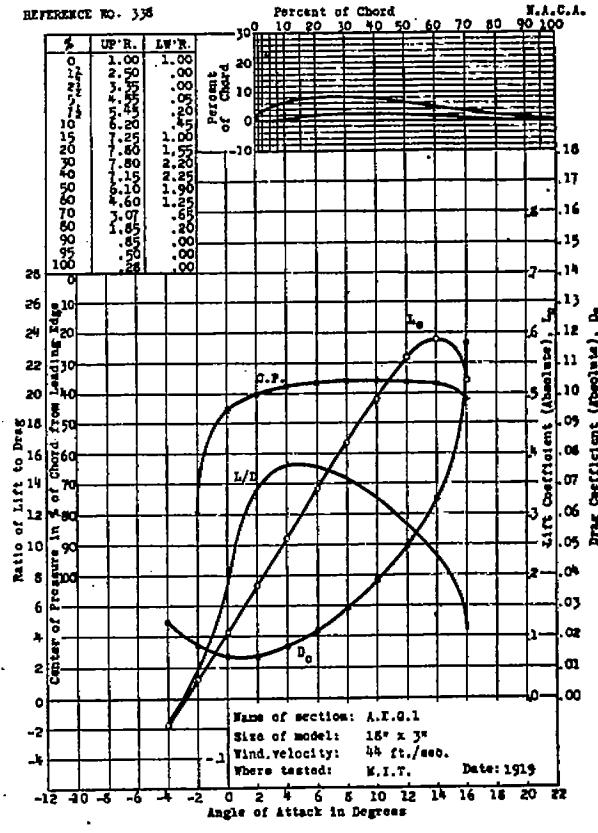
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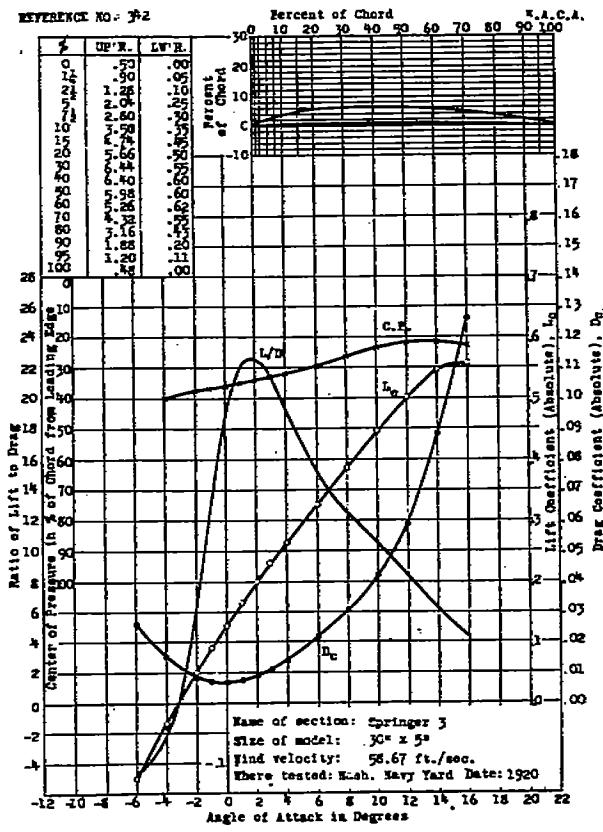
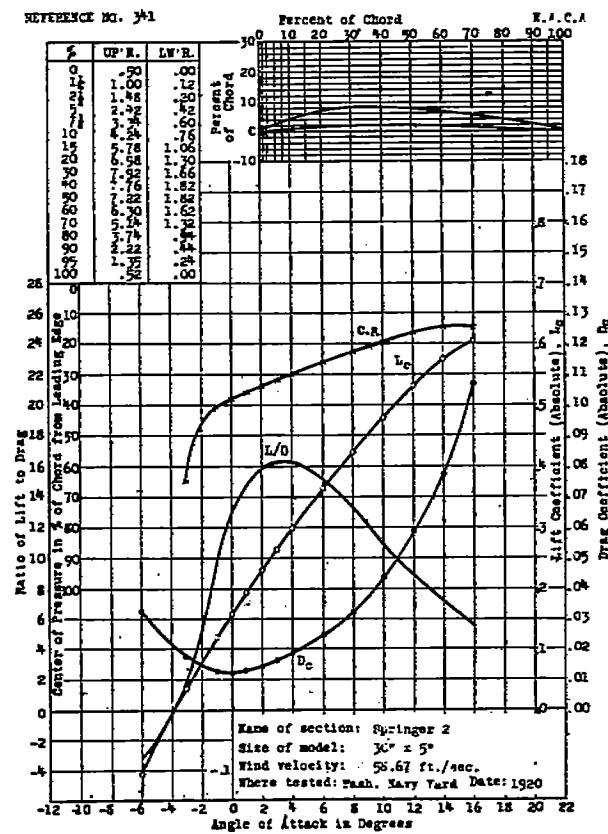
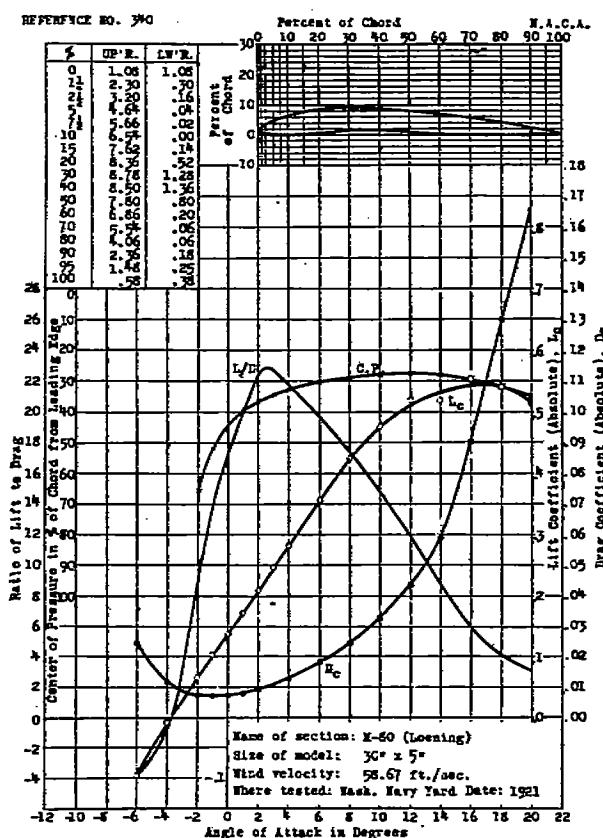
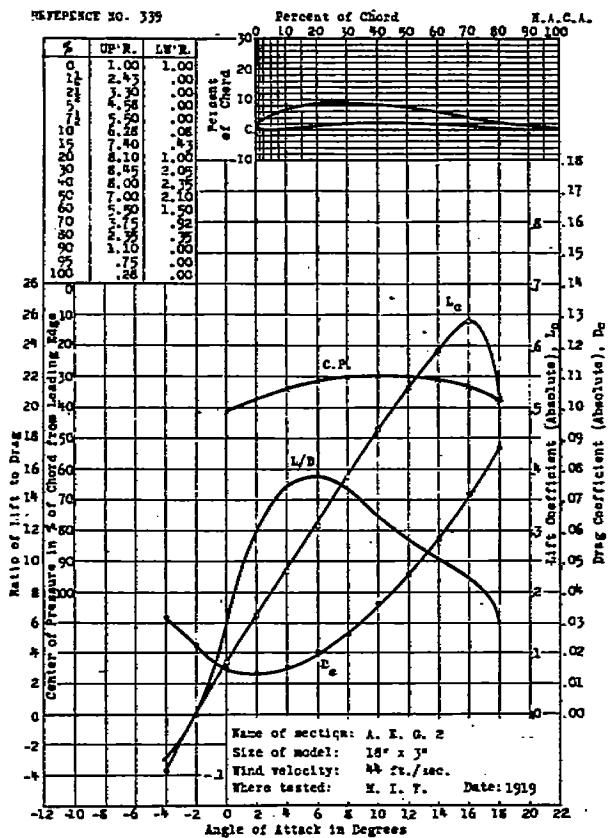


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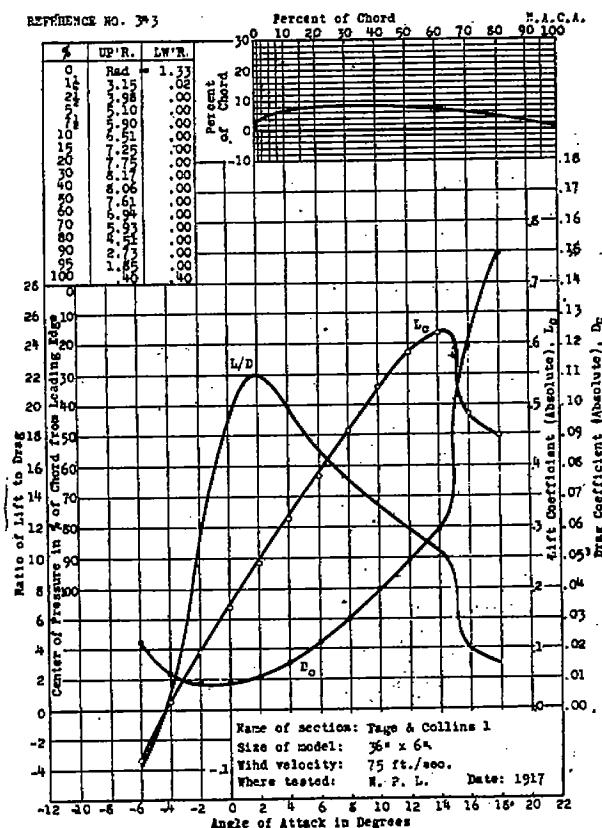


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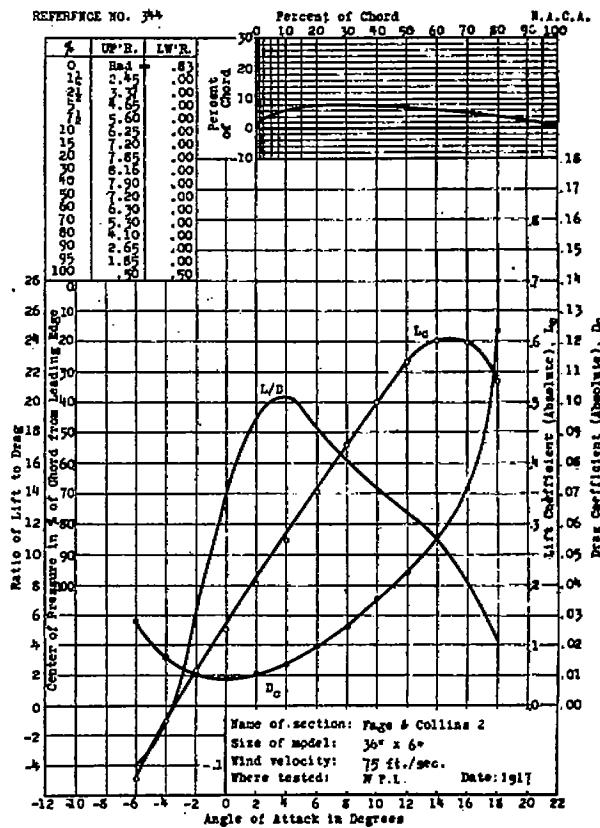




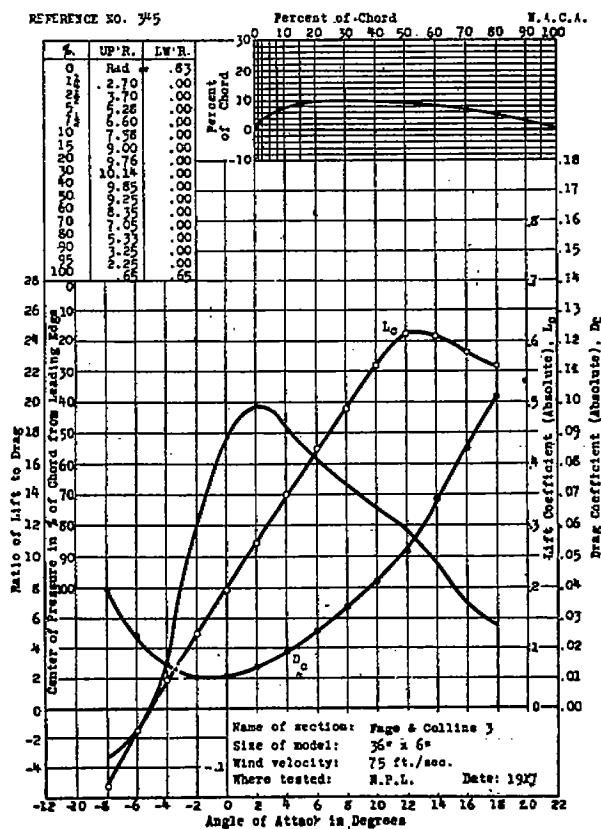
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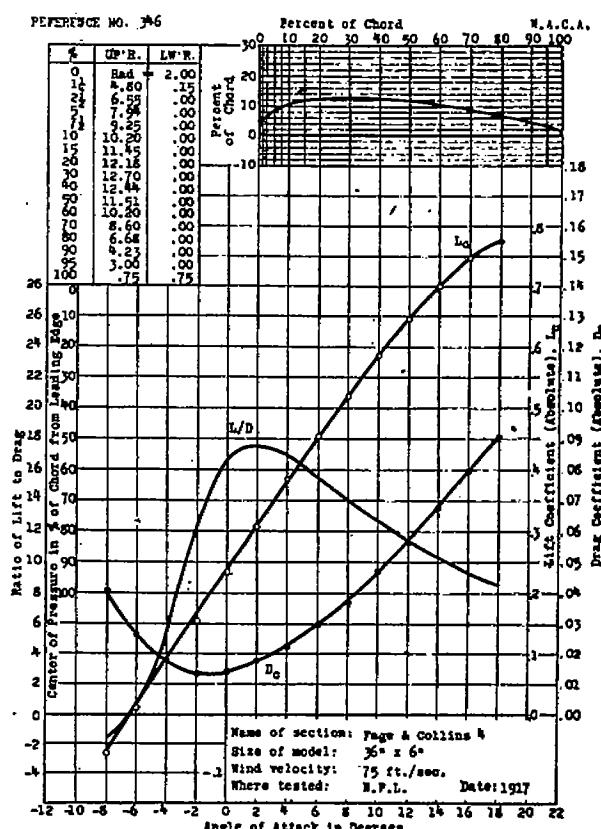
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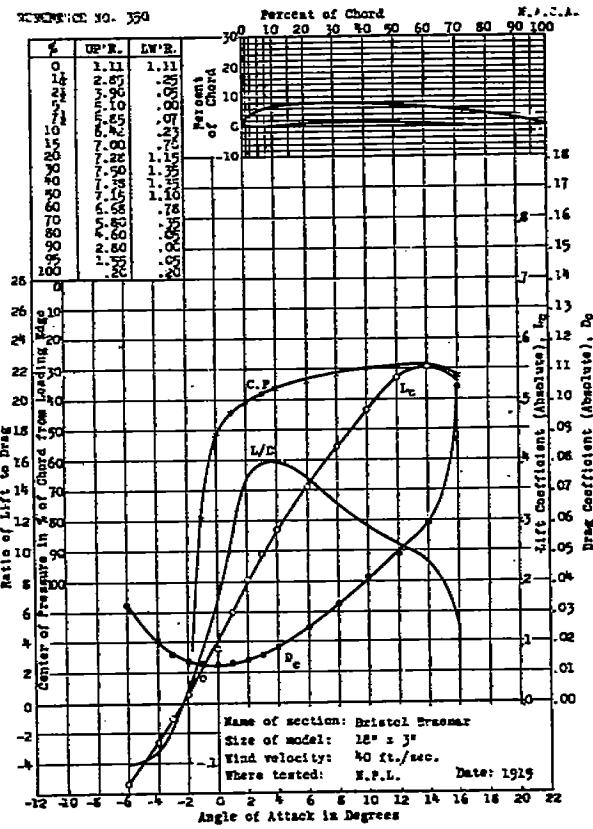
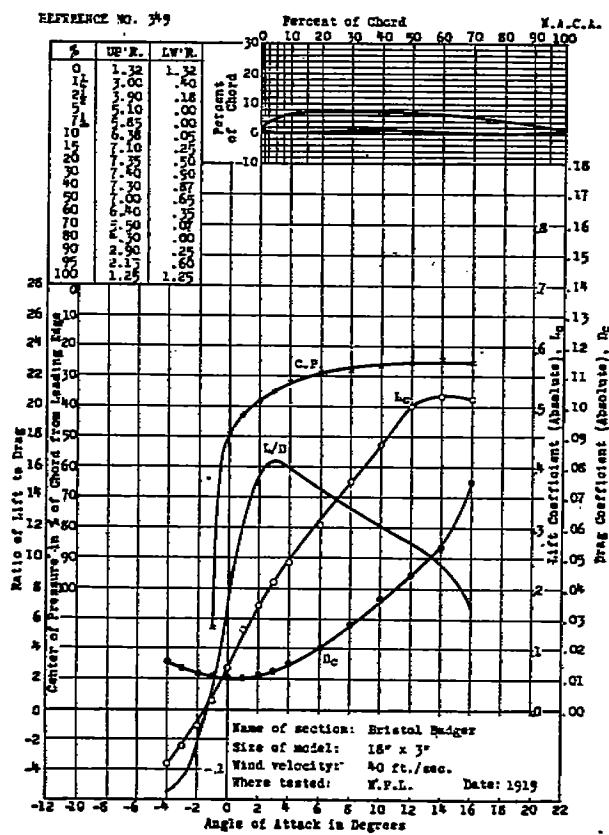
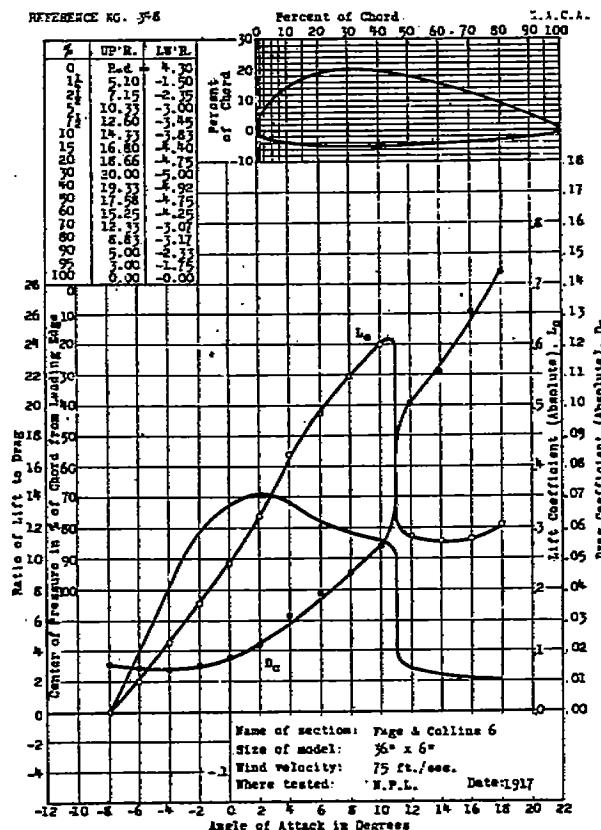
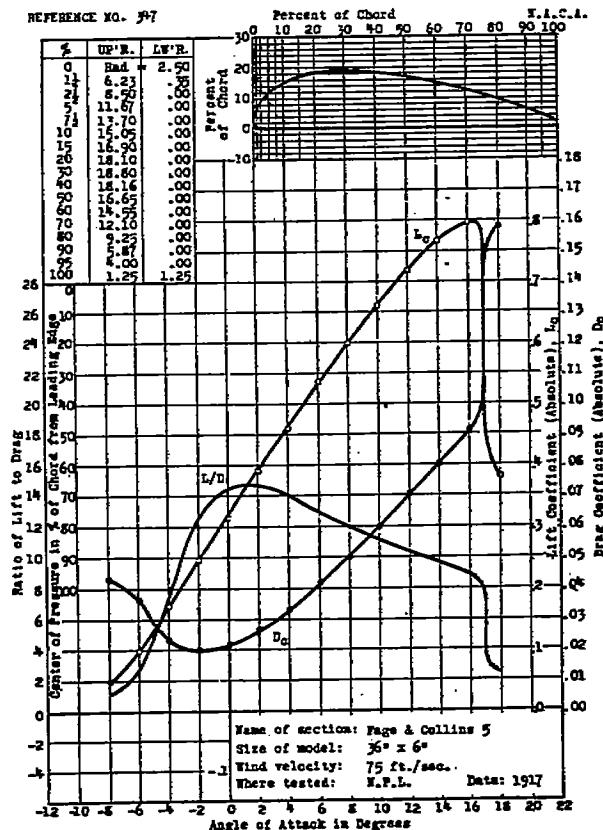


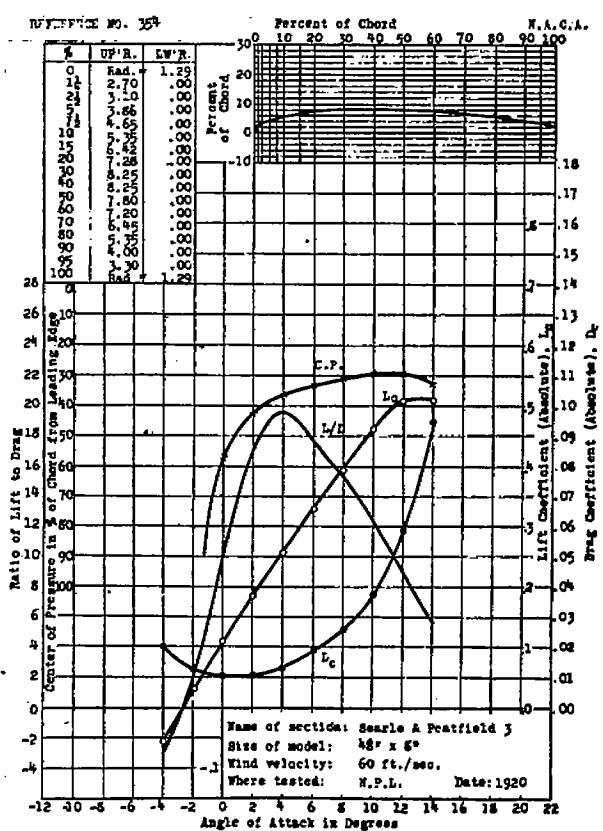
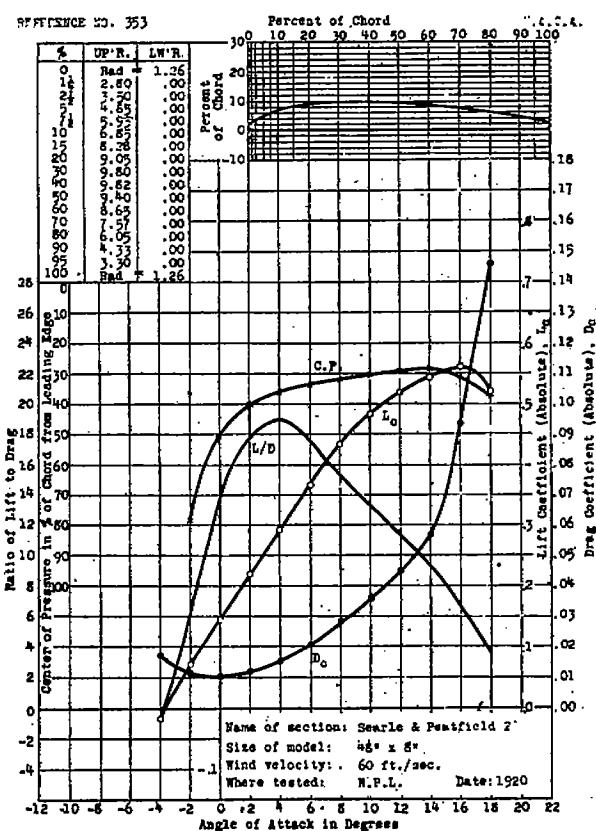
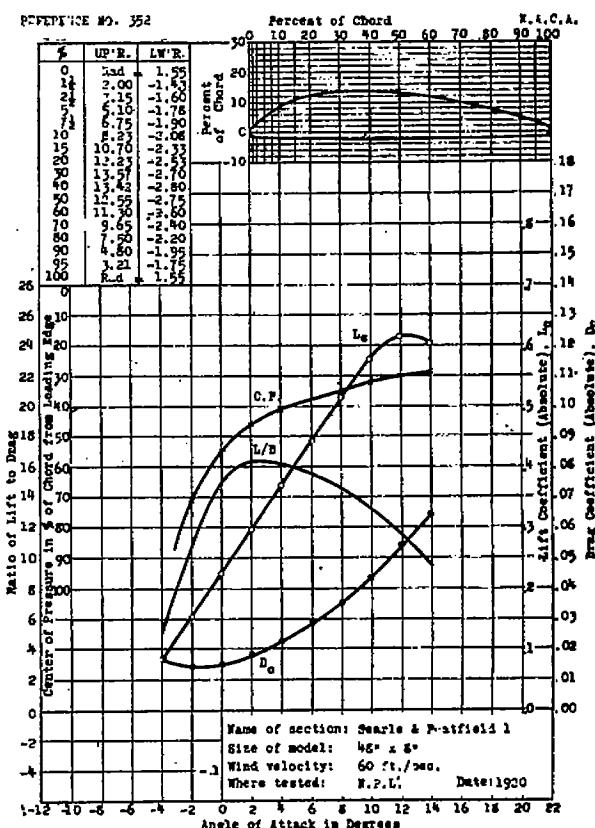
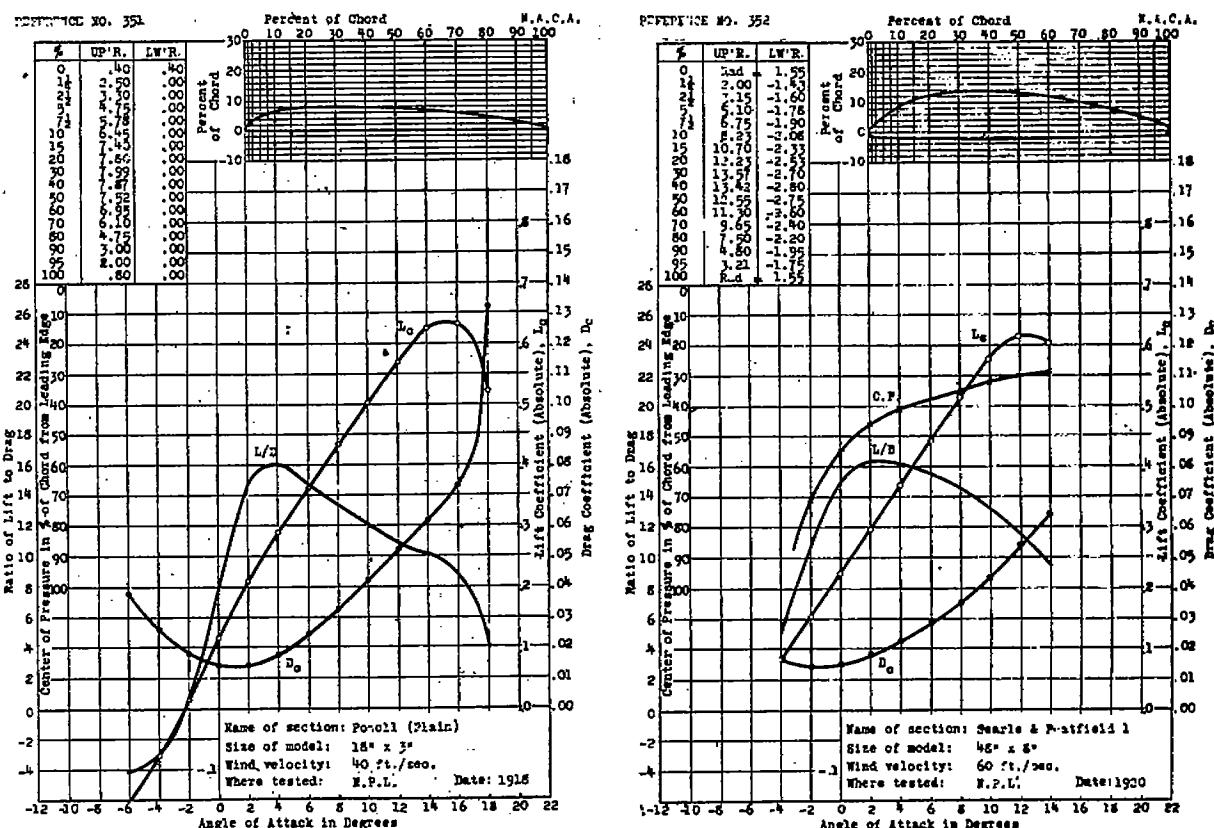
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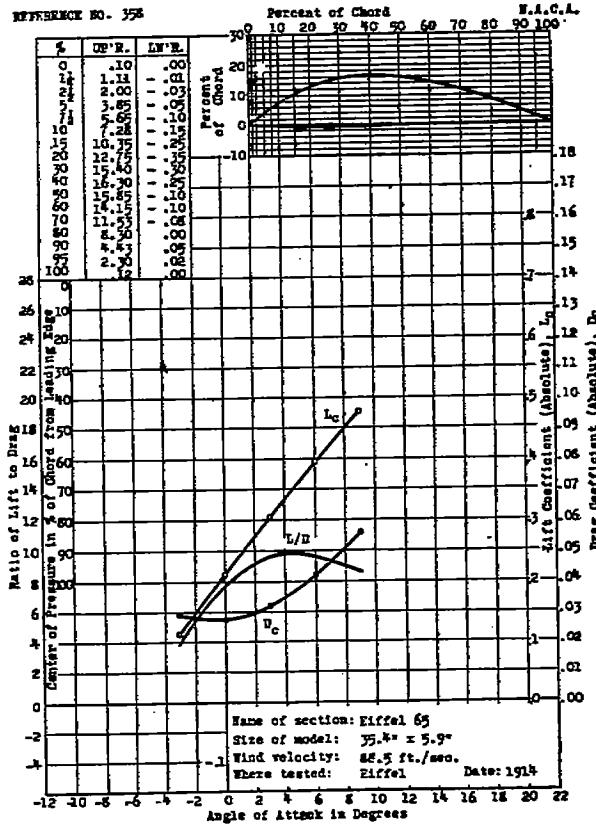
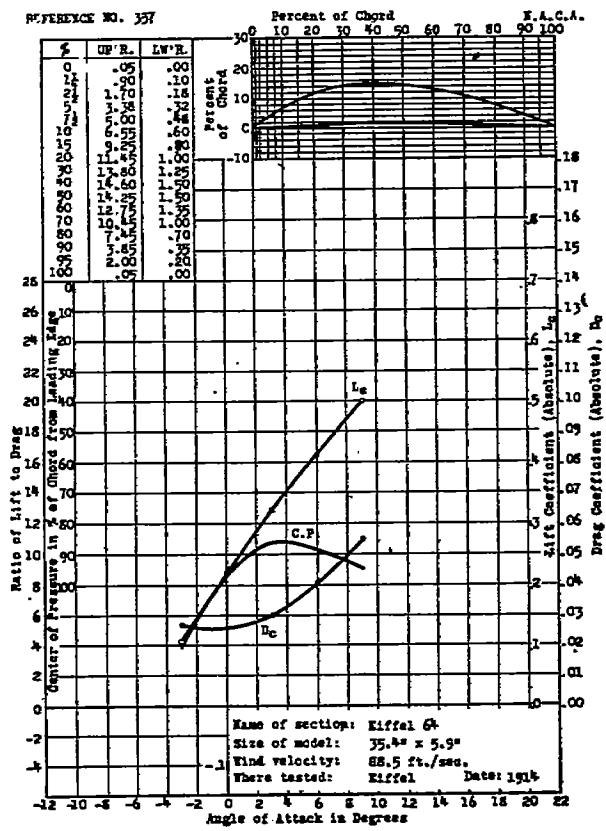
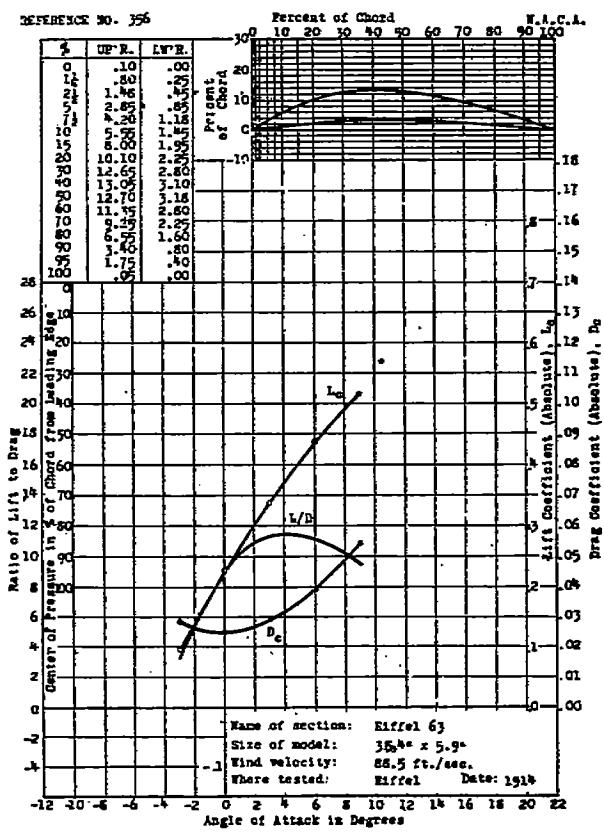
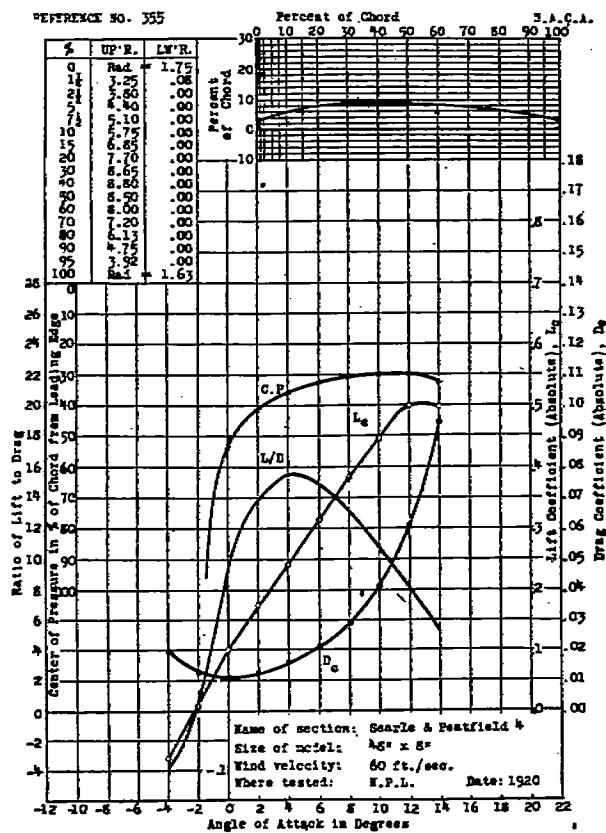


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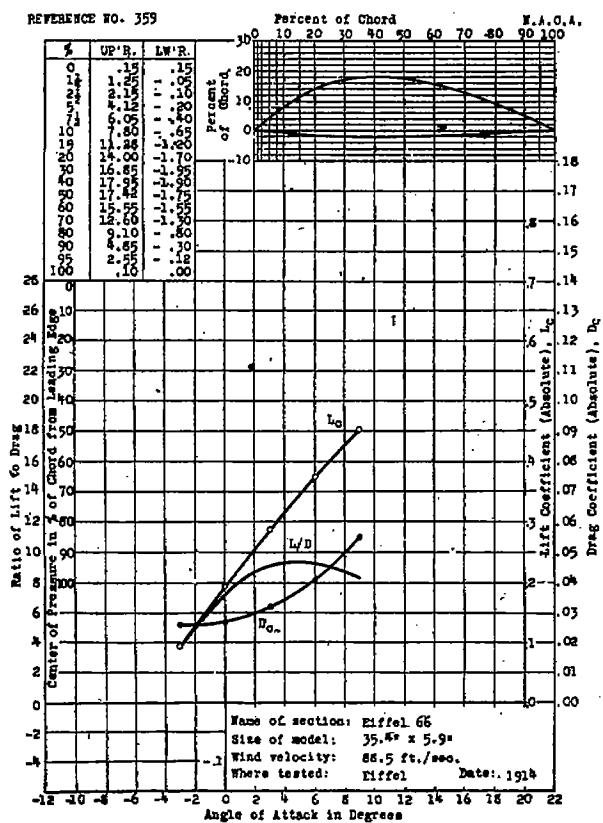




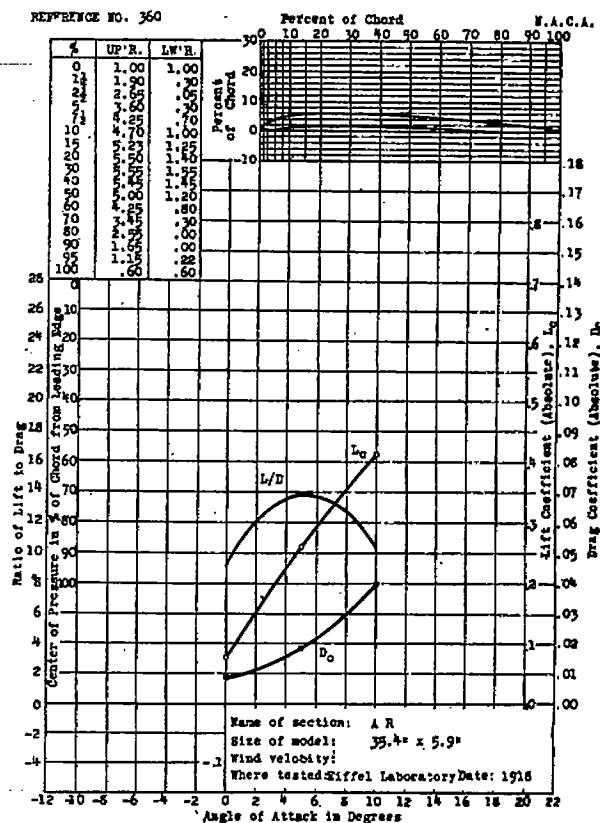




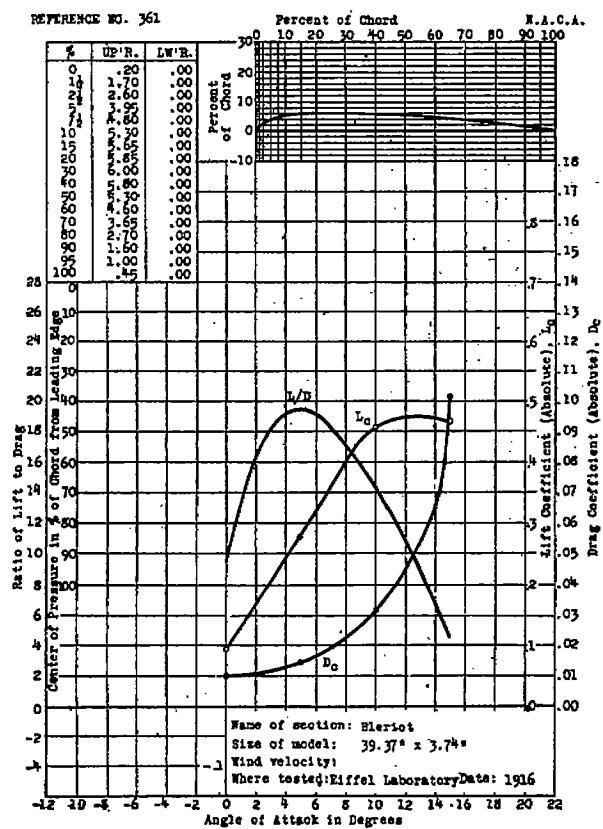
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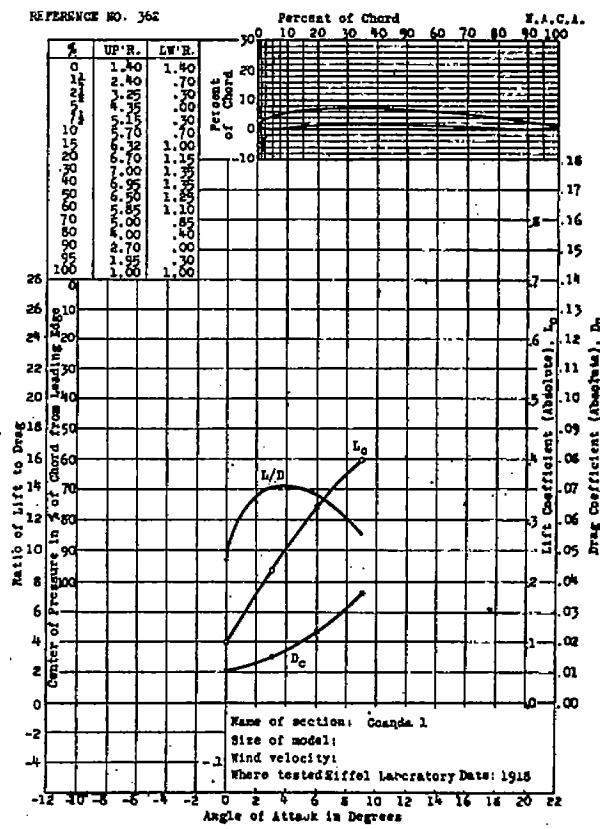
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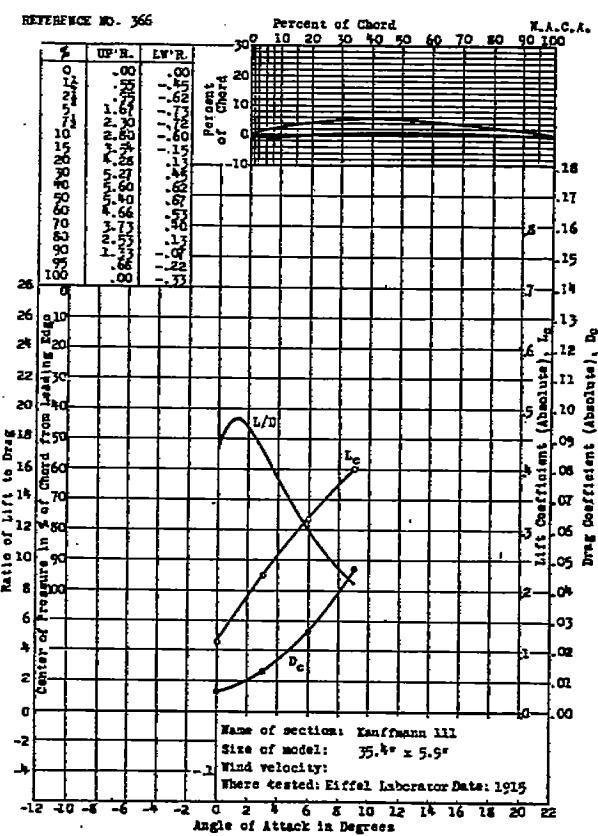
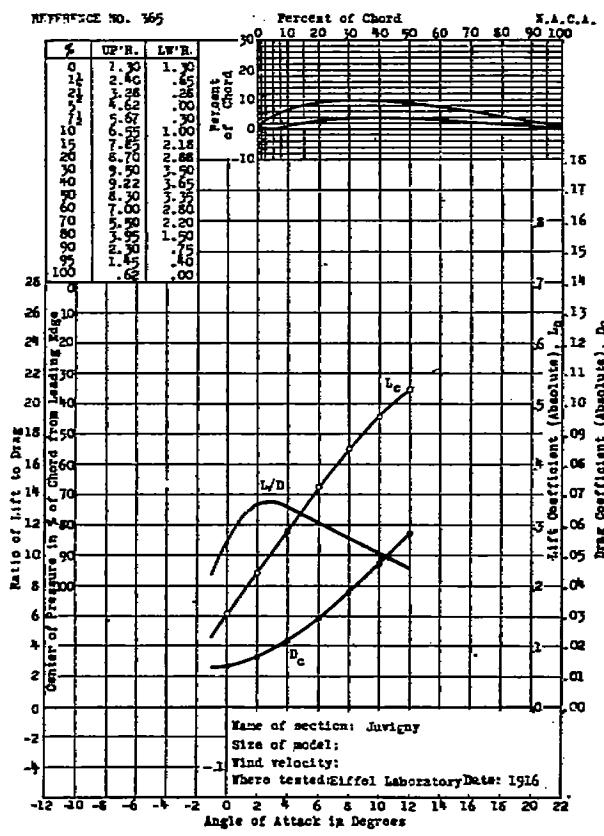
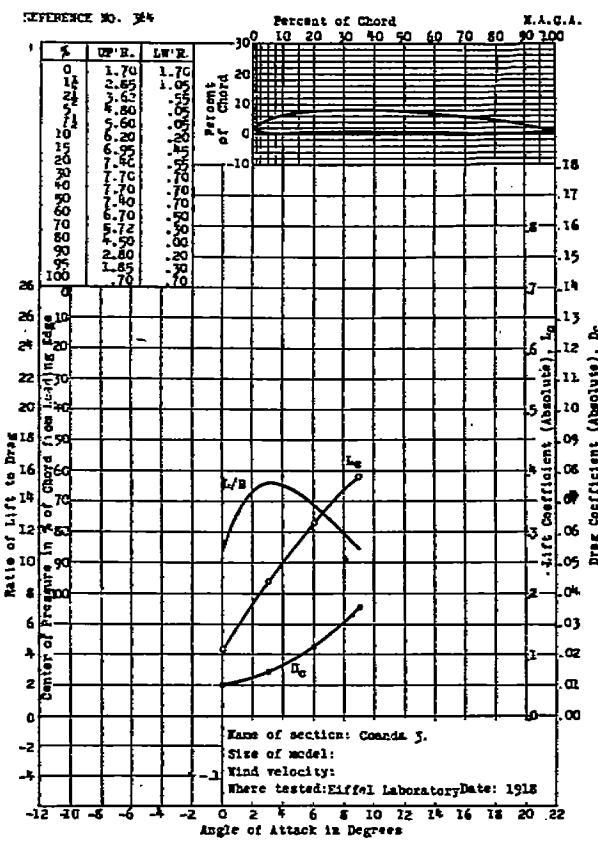
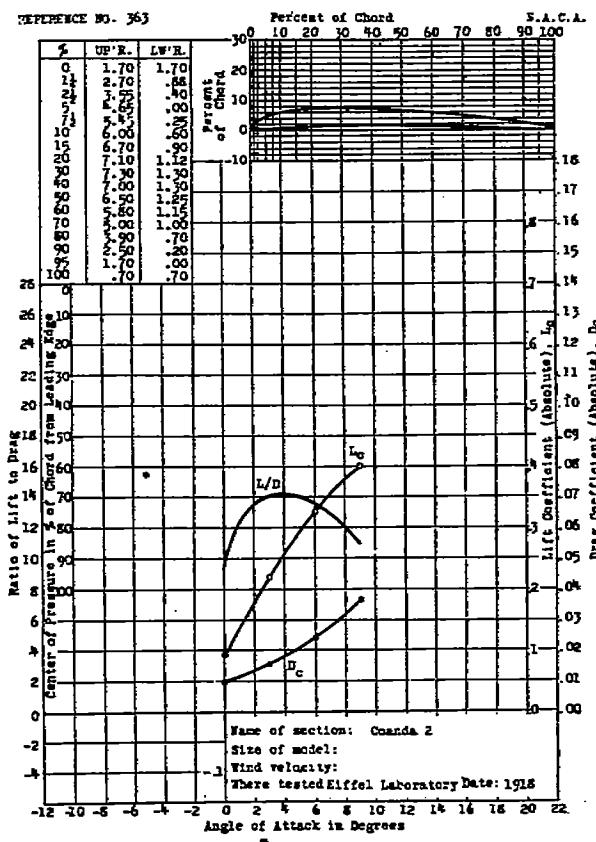


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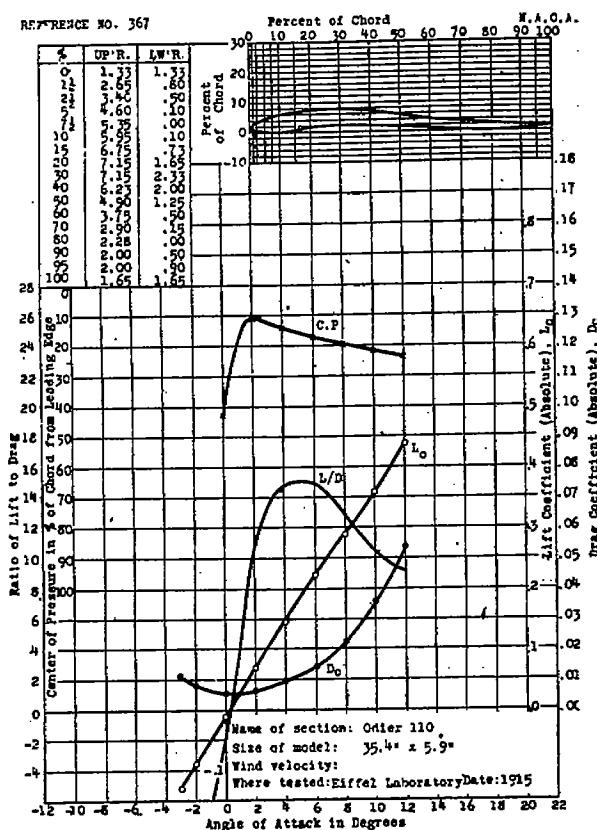


AERODYNAMIC CHARACTERISTICS OF AEROFOILS—II.

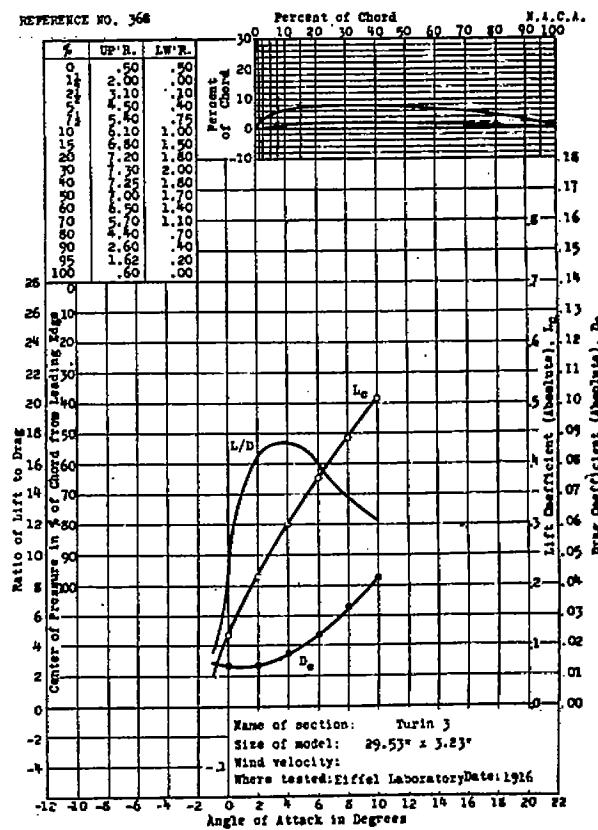
467



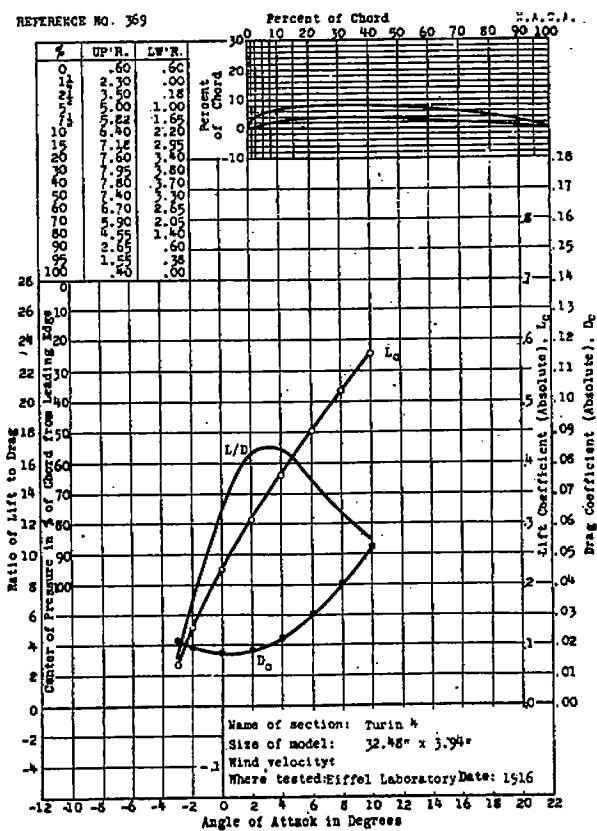
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REFERENCE NO. 368



REFERENCE NO. 369



REFERENCE NO. 370

